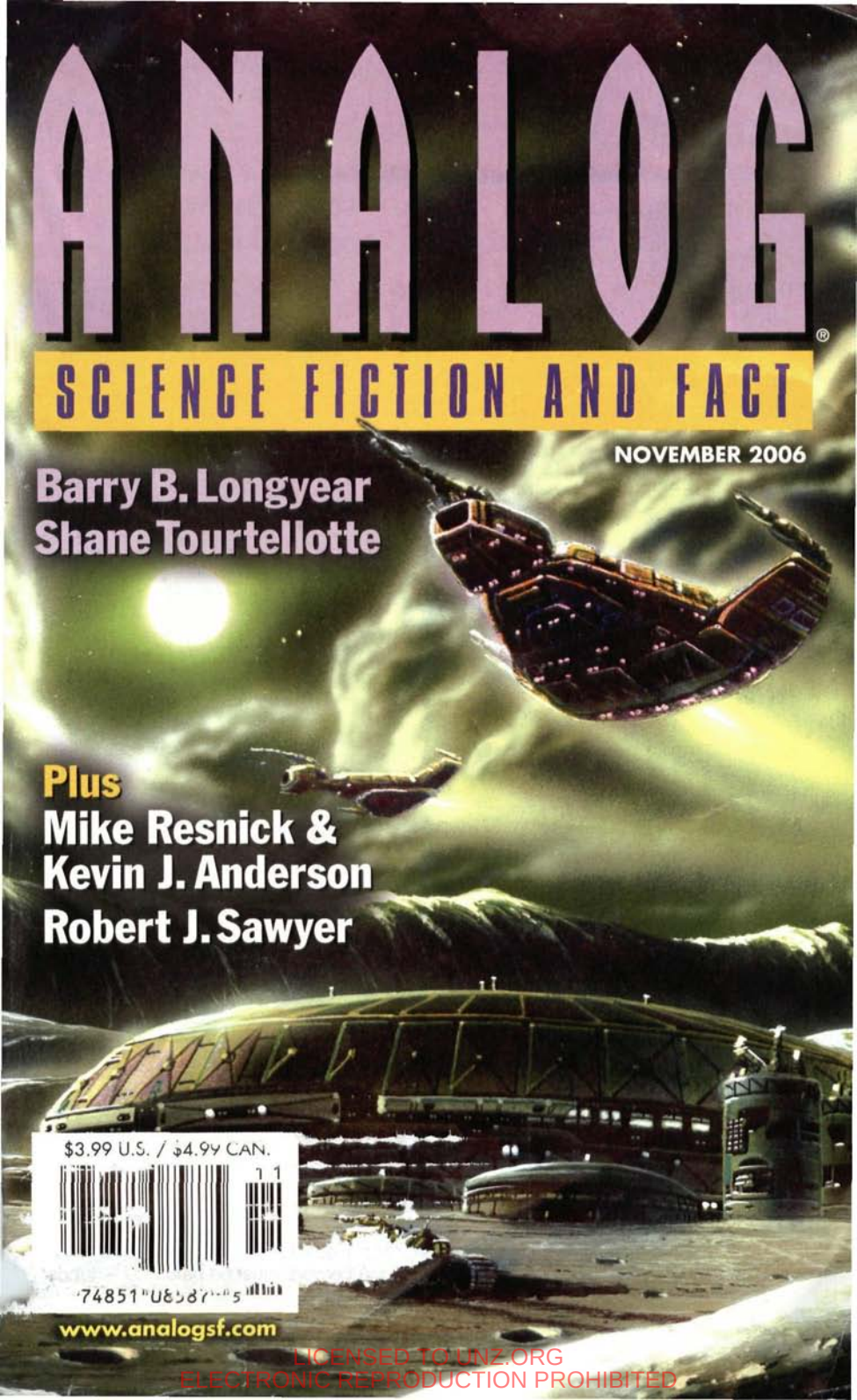

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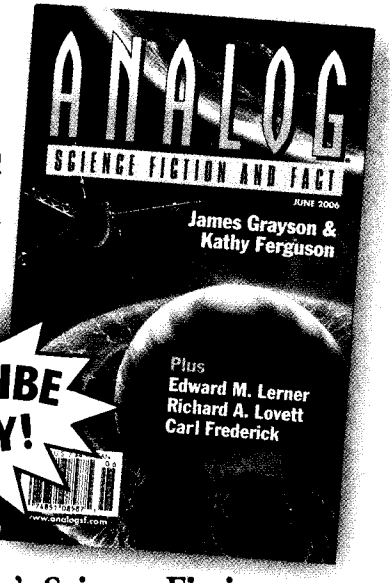

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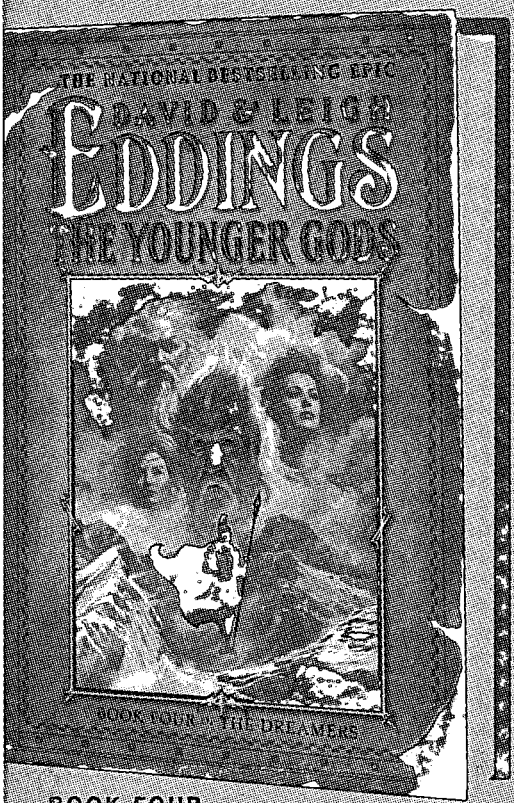

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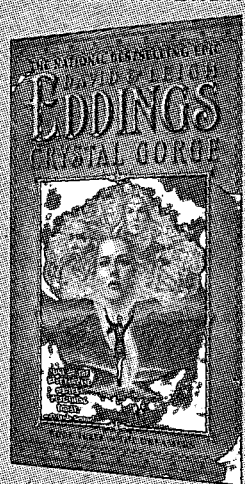

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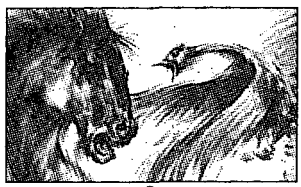

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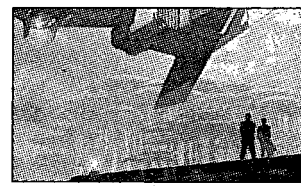

80

SERIAL

ROLLBACK, Part II of IV, Robert J. Sawyer ____ 102

NOVELLA

THE GOOD KILL, Barry B. Longyear ____ 8

NOVELETTE

WHERE LIES THE FINAL HARBOR?, Shane Tourtellotte ____ 80

SHORT STORIES

PREVENGE, Mike Resnick & Kevin J. Anderson ____ 54
MAN, DESCENDANT, Carl Frederick ____ 63

SCIENCE FACT

THE INTERSTELLAR CONSPIRACY, Les Johnson & Gregory L. Matloff ____ 44

READER'S DEPARTMENTS

THE EDITOR'S PAGE ____ 4
IN TIMES TO COME ____ 75
THE ALTERNATE VIEW, Jeffery D. Kooistra ____ 76
THE REFERENCE LIBRARY, Tom Easton ____ 134
BRASS TACKS ____ 141
UPCOMING EVENTS, Anthony Lewis ____ 144

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Indicia on Page 5

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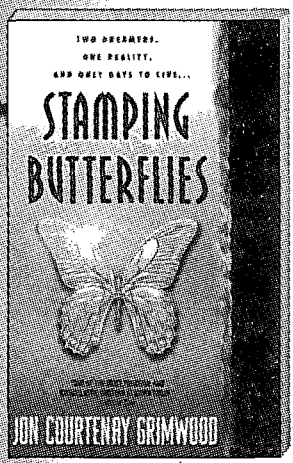

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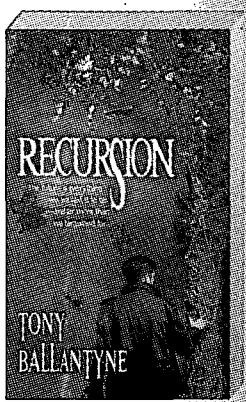

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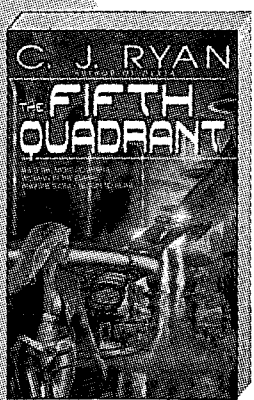

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THE TYRANNY OF PHYSICAL LAW

We've all heard the joke about the patient who tells the doctor, "It hurts when I do this."

To which the doctor replies, "Don't do that."

It's funny but also wise. While the patient can reasonably hope the doctor will be able to cure the problem and restore the ability to "do this" without hurting, unless and until that happens, the patient is well advised not to do the thing that hurts.

But how many of us actually have the patience and self-control to follow that advice—and how many can't resist the temptation to keep trying it to see if it still hurts?

The lesson extends far beyond medicine. There are plenty of things that the physical universe won't let you do, but people persist in trying to do them anyway. If a hose or electric cord is obviously caught on some unseen obstacle, people will often yank on it over and over, in just the same way except maybe harder and harder, all the while muttering coarser and coarser language in frustration that it won't behave the way they want it to. Drivers stand tall bags of groceries upright and unfettered on car seats and get angry when they plunge forward and spill their contents at the first less than perfectly gentle stop, even though they've seen it happen many times before. Or leave plastic toothbrushes or CDs on the dashboards of locked cars on hot summer days, and feign surprise and indignation when they melt and flow into amusing but otherwise useless shapes.

We're often advised, "If at first you don't succeed, try, try again." But often the more sensible and useful advice would be, "If at first you don't succeed, try something else." Simply repeating something that you've already established doesn't work is most unlikely to work any better now than it did then—because physical objects follow physical laws, quite consistently, whether you like them or not. At the macroscopic level, at least, a particular action will almost certainly produce a particular result—the *same* result, time after time.

Simply pulling again, or harder, on a stuck hose or cord accomplishes nothing because the obstruction is still there and still has the same effect it did. (If you pull hard enough, of course, something may break, but that will probably have unwelcome side effects.) Newton's laws of motion dictate that if a car comes to a fairly rapid stop, loose objects with high centers of mass *will* try to keep going and thereby tip forward. The greenhouse effect as applied to a sunlit car with glass windows dictates that objects with low melting points left there *will* melt.

All of these things are annoying, sometimes to the point where it may seem that the Universe has it in for us. But none of them is surprising, if we think about what's going on and remember some of the very basic things we all know about how the world works. So rather than railing at the Universe for making bad things happen to us or not

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letting us do things exactly the way we'd prefer, we'd be well advised—like the aforementioned pain patient—to refrain from doing the things that we know don't work, and concentrate instead on learning to do the ones that do.

In this respect, we have one big advantage over that hapless patient. Physical laws unequivocally forbid some actions, but they just as unequivocally allow, and even require, others. It's pointless to grumble about the things nature won't let you do (like leaving a toothbrush on the dashboard in the desert and expecting to use it the next morning). We should concentrate instead on learning to utilize the things it does allow (like protecting the toothbrush from the heat by keeping it an insulated container in a shaded place).

The spray hose in my kitchen sink sometimes gets caught as I described above, by getting a loop behind one of the shutoff valves under the sink. Pulling repeatedly in the same way does nothing to free it because it's still behind the valve, but snaking it in and out a few times while gently twisting can easily move it out of that position and end the problem. If grocery bags keep flying off the seat when you brake your car, there are at least a couple of ways to prevent that in the future—e.g., strapping the bag in with a seat belt, or simply loading it so the heaviest items are at the bottom. Or both.

I must, of course, say a few words about "Murphy's Law[1]" and the "innate perversity of inanimate objects." Both seem so perfectly descriptive of so much human experience that it's sometimes hard not to think of them as rigorous scientific concepts. And it's true that some real objects don't seem to behave consistently. An electronic device may work fine at some times and not at all at others because of a loose wire that sometimes makes good contact and sometimes doesn't. Anybody who's been driving very long has probably had car problems that occurred only when the car was hot, or cold, or turning left or turning right.

Yet in all of these cases, if you look closely enough, it turns out that even intermittent problems are following the same relatively few and simple physical laws. If you find that loose wire, for instance, and resolder it securely, the gadget it occupies will again work reliably.

And often the "innate perversity" of objects simply means they're doing exactly what they're made to do, which does not coincide with what we'd like them to do. In many of these cases the objects are human artifacts and the limitations are technological—not fundamental physical principles, but the sorts of things that computer users call "bugs" and computer salespeople call

[1]"If anything can go wrong, it will."

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"features." In many such cases you can change the limitations by changing the design, though implementing the improved design may be expensive. If you can't or don't want to do that, you can often learn to achieve your main goals with what you have, simply by learning what the design limitations are and how to work within them.

My house, for example, has an integrated heating and hot water system in which water is heated when needed by a coil attached to the boiler. One of its less endearing design features is that the bathtub faucet can draw water at a considerably faster rate than the coil can heat it, so if I want to fill the tub with nice hot water as quickly as possible, turning the hot water on full and leaving it that way is exactly the wrong way to do it. If I do that, I'll *always* wind up with a tub full of cold (or at best lukewarm) water. Fully opening the valve first quickly pulls the cold water out of the pipes so you (briefly) get very hot water; but soon you exhaust that and it continues to draw water that hasn't stayed in the coil long enough to get hot. Once you understand that that's what's happening, you can use a method that gives much better, if somewhat slower, results: turn the hot on full only until the water gets hot, then cut the flow back to maybe half that and adjust the temperature with the cold knob. That way the hot water is heated as fast as it's drawn off, and you can maintain the temperature you want.

That doesn't mean it's trivially easy; you have to develop a feel for what the maximum allowable flow is, because if you exceed it by even a little you're soon back to cold water. And it does take longer to fill the tub this way than if you could just turn the hot water full on and expect it to maintain full temperature. There are systems that can do that, and we'll buy one eventually (likely as soon as this year, since fuel prices are now so high that a more efficient system shouldn't take long to pay for itself). But so far it's been a relatively low priority because the new system will be a substantial investment, there've been more urgent demands on the budget, and we know a usable workaround.

And in some cases, the option of upgrading to a better system just doesn't exist because the limitation is not just a matter of technological design, but a fundamental physical law. A favorite example for science fiction readers is the

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apparent speed-of-light limitation on mechanical travel. It's conceivable that a loophole may someday be found even there, in basically new science as yet undiscovered; there are even hints that a way around it may be implicit but not obvious in the existing theories of relativity and quantum mechanics. Unless and until such a thing is found, though, any aspiring starfarers will have to accept that limitation and find other ways, such as highly relativistic speeds, suspended animation, or generation ships.

For a more mundane example, humans spent thousands of years wishing they could fly like birds; but no matter how hard they flapped their arms, with or without things attached to them, they couldn't get off the ground. It just isn't possible to generate enough lift that way to raise a human mass against the pull of Earth's gravity. But if you learn enough about fluid dynamics and combustion and materials science, you can develop other ways that work well enough to routinely carry hundreds of passengers at a time on regularly scheduled transcontinental and transoceanic flights.

Learning, of course, is the key. It's frustrating that the laws of nature are absolutely unyielding in denying us the ability to do certain things. But because those laws apply consistently, understanding them gives us the power to do a great many other things. All of us understand this on at least some level. It's fashionable in too many circles to say almost with pride, "I don't know any physics," and to sneer at any display of interest in learning any. But the people who say they don't know any physics are wrong. People (or other beings) who don't understand any physics don't survive to adulthood.

If you've ever thrown a baseball, driven a car, guided food to your mouth, walked across a room, or even rolled out of bed without breaking anything, you were applying quite complicated physics. What most people don't understand is not physics, but the formal language that physicists use to talk about it. More of them need to understand the value of learning at least some of that language, because that is the way to understanding the ways of the world well enough to make them work for you in ways beyond your own body—things like building cars, planes, and microwave ovens that work, and buildings and bridges that stand up.

For while the laws of nature are in one sense tyrannical, they are in another sense empowering. They tell us not only what we can't do, but also what we can—and how. The better we understand them, the more we can shape our lives to be the best they can. ■

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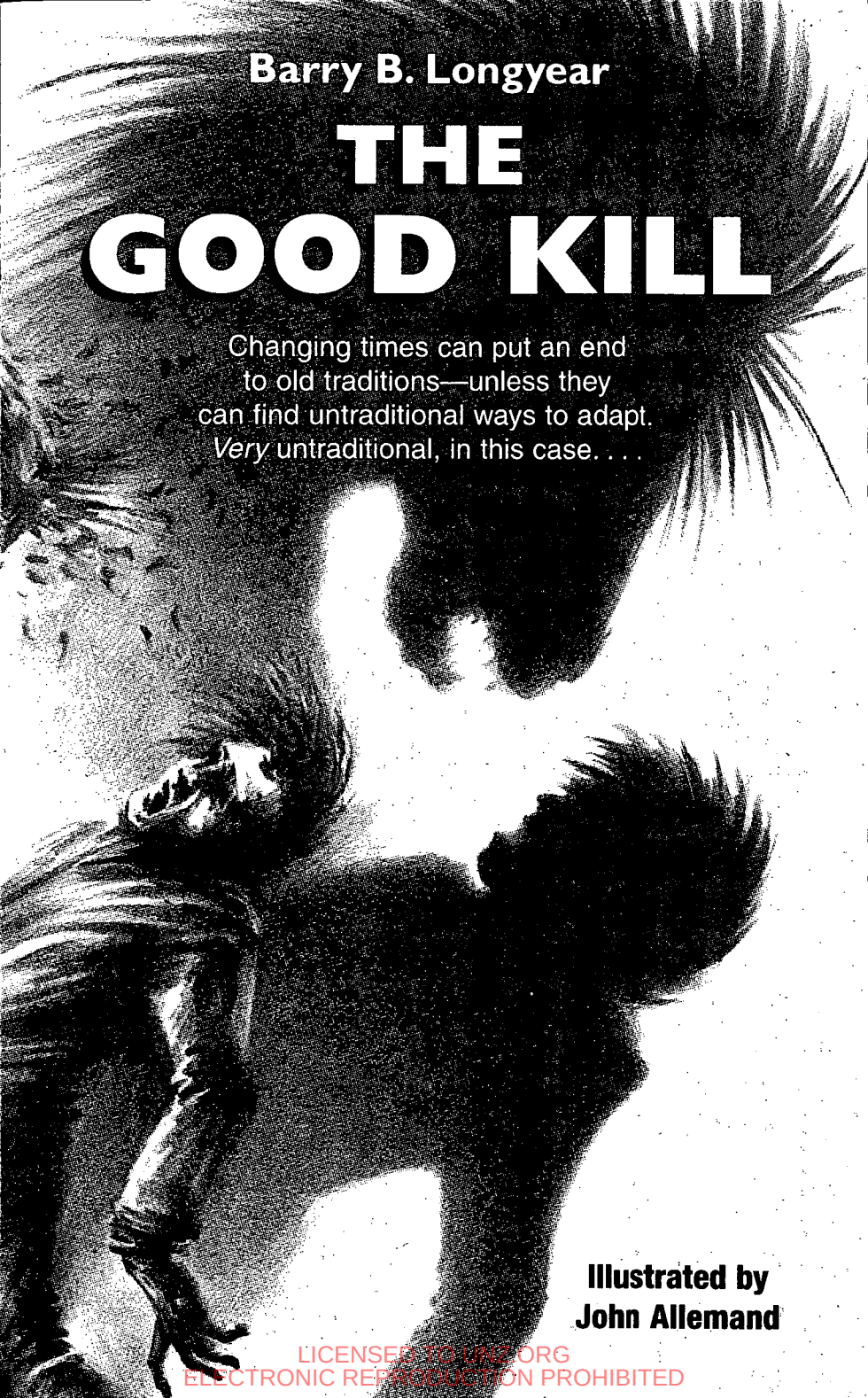
Barry B. Longyear

THE GOOD KILL

Changing times can put an end to old traditions—unless they can find untraditional ways to adapt. *Very* untraditional, in this case. . . .



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The Rent-A-Mech, Walter, had just put my breakfast on the table when D. Supt. Matheson rang me. *"Forgive me for ringing you so early, Jaggers, but London ABC wants us to look into that fox hunting matter at Dartmoor. Apparently there's an amdroid involved. It's an outdoor scene and if you don't move quickly the evidence may become contaminated. . . ."*

Matheson hadn't begun with a knock-knock joke, which meant he was troubled. The Miles Bowman death was the biggest story to hit Devon in decades. The wealthy and charismatic Master of Houndtor Down Hunts had died, I had gathered from yesterday's news reports, when he had been thrown by his horse during a run. Apparently someone in the park police was exploring another theory.

Val momentarily looked up from the table where she had been lapping her single cream. Seeing nothing to distress her, she twitched her tail as if to launch an unwelcome insect and resumed emptying the saucer. A sepia and golden Tonkinese, her soft coat colored in a random watermarked silk pattern, she was much too elegant ever to be observed using the litter box, although I supposed she must be using it. It was, after all, being used. Perhaps she had friends in.

"Jaggers? Jaggers, there. Pay attention. Blast! When are you getting a modern screen phone? Bloody hell. Jaggers?"

With a parting glance at my rapidly cooling eggs and bacon, I responded into the handset, "Yes, Superintendent. You were saying?"

"Now, I've made a good number of allowances for you, Jaggers, because of your record. You were once an impressive detective. Do not take advantage. Am I understood?"

"Certainly, Superintendent."

"You're going to want to get to the scene before it rains."

I shifted my gaze to the glass door that looked into the garden as Matheson continued. The mid-March sky over the city was gloomy grey with curtains of mist coming up from the river. *"The park constabulary think they have their murderer, Jaggers. London wants us to go through everything. After all, artificial beings are our bailiwick. Ready to receive?"*

I toggled the receive on my hand desk. "Go ahead, Superintendent."

"Sending now."

As the case file form and location instructions loaded, I mulled the late Miles Bowman's place in the scheme of things. In certain upwardly crusted circles, Bowman's death was immense. Houndtor Down had brought riding to the hounds and the good kill back to Albion after an eight-decade hiatus, dotted with less than satisfying drag hunts and those absurd experiments with AI-equipped robotic foxes. Houndtor's answer was to introduce genuine bio fox amdroids for prey, but imprinted with human engrams. The fox, therefore, would be physically a fox, but no longer a fox according to the prohibition against fox hunting, in that the creature understood the consequences and could volunteer. In actuality, the vermin was a human in a fox's "meat suit," entitled under law to engage in whatever absurd, but legal, occupation he or she chose. Nevertheless, where one got volunteers was a puzzle.

I'd never been at the Houndtor Down Lodge, although I had witnessed a bit of one of the operation's hunts on Cripdon Down the year before when I was on an easily resolved poodle abuse enquiry. The amdroid poodle had undeniably abused her owner, a Harley dealer from Torbay. However both poodle and woman confessed to being consensual S&M partners in the area for a hunt, hence no crime. Too bad really. The poodle matter promised to be the most interesting case I'd been on since being assigned to the Exeter office. Neverthe-

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less, since I was on the moor then and a hunt was on, I watched. Except for the chase being followed above by a hoard of hovercraft, the hunt itself had been something caught in amber. Elegantly costumed riders mounted on magnificent steeds chasing a huge pack of handsome foxhounds, the peculiar warbling notes of the Master's tiny horn signaling the sighting of the prey. As long as you weren't particularly fond of foxes, it was rather uplifting.

The lodge was twenty-five kilometers southwest of the city, just beyond the village of Lustleigh on the east edge of the moor. The enormously lucrative concession had its own skydock, and the park detective in charge, one DCI Stokes, condescended to have a constable at Houndtor Down to bring us up to speed. "Superintendent, on the killing, did the park cops get a verbal?"

"No. This Stokes fellow is certain he has his killer, nevertheless: Lady Iva Bowman, Miles Bowman's wife."

Lady Iva Bowman. The image of that stunning beauty was fixed in the nation's memory. Her marriage to Bowman had been little short of a media coronation.

"Their theory is Bowman and Lady Iva, along with the hunt staff and some eighty followers and club members, were in the middle of one of their smaller commercial runs when Miles was found dead along the route. Lady Iva inherits and I gather from DCI Stokes she had just learned that her husband was bonking the company's lead second horseman, one Sabrina Depp."

"Motive and opportunity," I commented.

"They're up the wrong branch, Jaggers."

"You disagree, sir?"

"I knew Lady Iva years ago. For all her beauty, she is old school, very refined. I can't see her getting down into the muck and beating a grown man to death with what appears to have been a horseshoe, regardless of the provocation. In fact, I rather suspect Miles Bowman's horse."

"An amdroid?"

"Yes. The horse isn't running on a human imprint, though. It appears a year ago a favorite jumper of Bowman's was near death from an injury and Bowman spent a not inconsiderable fortune to have the mount's engrams copied and imprinted on an equestrian meat suit drawn from the mount's own DNA."

"That which Miles rides shall never die," I dogmatized.

"Quite. I suspect Bowman's nag determined one lifetime under Miles Bowman's arse was sufficient."

"In which case, Superintendent, it wouldn't be a murder."

"All of which I imagine Lady Iva would very much like to have established as quickly as is feasible—oh. Swing by Heavitree Tower before you leave for Dartmoor. You have a new partner: DS Guy Shad."

"You're having a laugh, right, Superintendent?

"Not really."

"Guy Shad? Sounds like someone copied the name off an old action vid poster."

"That is his name, Jaggers. Shad is an American."

"Of course he is. Now, we agreed—"

"This isn't a negotiation, DI Jaggers. Shad has been assigned to this enquiry because of his prior association with two of the principals, as well as his familiarity with the artificial being end of the law enforcement spectrum. He'll be waiting at the skydock." That warning edge crept back into the superintendent's voice: *"Grasp the nettle, Jaggers. It's up to you to make this work."*

"Yes, Superintendent."

A significant pause and then the superintendent decided to lighten the mood. *"Jaggers: Knock, knock."*

"Ringing off, Superintendent. There appears to be someone at the door."

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- I quickly hung up the handset as I muttered, "Brilliant," to no one in particular. After the dreadful experience I had partnered up with the ever-effervescent Ralph Parker, I thought Matheson and I had agreed I always work solo.

Guy Shad. American. He'll want to eat at Wendy McDonald's Kentucky Burger Hut and call me Bud, I mused. I certainly hoped Parker's meat suit was one of a kind. I'd go into retirement before I was made to work with another Parker.

I looked at Val and she was eyeing my bacon and eggs. "You may as well," I said to her as I petted her head and went toward the hallway to get my raincoat and hat. "I have to get to work. I'm on the Miles Bowman matter."

"Is something wrong?" she asked.

"The superintendent's assigned me a new partner. An American named Guy Shad."

She looked at me with those stunning aqua eyes and said, "Give him a fair chance, Harry. I don't want to worry. Is Walter coming in this evening?"

"Yes."

Val looked at me for a moment then averted her gaze. "I'm sorry I can't cook for you, Harry."

"You catch mice. That's quite as important."

"You're a dear, but you know Walter keeps this place so clean, there hasn't been a mouse to catch in months." She turned back to my plate and continued lapping at the yolk.

"Have a good day, dear," I said and closed the door.

As the division sky cruiser assigned to me headed south into the muck above the city, I ran up the mechs in case we'd have to copy into them. There probably wasn't going to be any need to get small; the animal android involved, after all, was a horse. Nevertheless, routine is its own reward, as the superintendent was wont to remark between knock-knock inanities. They were ugly little mechs, but useful for following assorted beings into places tight, high, or otherwise inaccessible to humans. While they went through their system scans, I checked InterNews on Miles Bowman's death. Indeed, Lady Iva had been taken into custody, Detective Chief Inspector Raymond Stokes of the Devon-Exmoor National Park Constabulary stated in his news conference, blah, blah, blah. . . .

My mood was terrible, and it was time I faced up to it. I was having quite a bit of trouble letting go of having a new partner thrust upon me. I knew full well why ABC Division had human-imprinted animal androids as investigators. That's the criminal dimension that necessitated the creation of our component of Interpol. Still, almost every amdroid I ever worked with had such bizarre excuses for having wound up in a critter meat suit, I was convinced it couldn't help but have an effect on their work. It certainly had with Parker.

DC Parker had been the worst of a succession of amdroids assigned to work with me. It wasn't just the thick Estuary accent Parker affected, his odor, the incessant grunting, or that he had difficulty in controlling his bowels. It was Parker's effect on a subject during an interview. I don't think I'm being unfair when I say undergoing interrogation by a thirty-five-stone mountain gorilla puts some people off. Banana peels and fruit flies all over the cruiser, fleas. I mean, *really.*

As the cruiser descended out of the overcast above the new Consolidated Police Administration Tower on Heavitree Road, I could see that the only living being waiting for me on the skydock was a mallard duck complete with green head, white neck ring, chestnut breast, grayish-white feathers, yellow bill, and orange feet. "Showing at a crime scene with Daffy in tow; that'll put the yobs in a fright."

As the cruiser's computer control put the vehicle down in the center of the landing target, I declined a slot assignment, put the power on standby, and

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pressed the buttons to open both doors. I looked around briefly in waning hopes that this was some sort of practical joke, then resignedly got out of the driver's side and trudged over to where the duck was standing. "DS Shad?" I inquired.

"I'm Shad," said the duck in a voice that sounded very much like—a duck.

"Detective Inspector Jaggers," I introduced myself.

"I know just what you're thinking," he said. "'My God, a duck! I sure feel safe now that poultry has my back. Where ever does he keep his handcuffs? What was that idiot Matheson thinking to saddle me with this fugitive from a Chinese restaurant! I ought to go down to the superintendent's office right this minute and put in for my walking papers! You've laid an egg this time, pigeon-brain. This is for the birds! Are you out of your bleeding mind? *A duck!*' "

"Sorry. Didn't mean to ruffle your feathers."

He held out a wing. "Bird jokes? It's going to be bird jokes?"

"Actually, I was going to ask if you wanted to drive."

Shad lowered his wing, gave me a bit of a look, then flew into the open driver's side of the cruiser. "That went rather well," I muttered to myself.

I got into the passenger side, buckled in, and faced the duck. The power revved up, the doors closed, and the cruiser lifted off the landing target and headed southwest into the morning commuter traffic, the duck standing motionless on the seat. The GPS showed that our destination and control had somehow been given to the autopilot. "Wireless interface," smugly explained Shad.

"Something you should know about me, as well, Shad."

"What's that?"

"I am a detective inspector, your senior as well as your superior, and if you should ever shoot off your bill to me like that again, me lad, I'll stuff and roast your goose proper."

"Ah, yes, sir. I apologize, despite the additional gratuitous fowl references." After an awkward moment of silence, he glanced at me. "Admit it, though: I am an improvement on Parker."

"You met him?" I asked.

"Back at the tower he mentioned something about having been your partner. Does Parker have a banana problem?"

"At least." I glanced at Shad. "You do take up less space."

"And I don't crap in the cruiser."

"That is an asset." We both laughed at that.

Later, visibility almost down to zero as we approached the Alphington vector roundabout, Shad said, "Matheson told me to fill you in on my connection to Houndtor Down."

"Please."

"Back in New York about ten years ago, I knew Miles Bowman's business partner, Archie Quartermain. I was a human, Archie was English, and we roomed together in a roach hotel in the Village. Back then we were both starving, taking acting lessons, and trying to get theater acting careers started. Archie waited tables and hustled vidgames, and I was a part-time police assistant at the local precinct, answering phones, filing, that sort of stuff. We were doing cattle calls and getting an occasional walk-on. Remember the Gladys Hudder case, when that DNA bio of Cary Grant sued his owner for emancipation?"

"The case that took the 'slave' out of 'slavery' for the human-imprinted and self-aware AI population."

"Yeah, what would you rather be: an eighty-year-old woman's boy toy or a filthy rich reincarnated Hollywood superstar covered with babes?"

"Decisions, decisions," I added.

"Anyway, that case put Archie onto something," Shad continued. "He wouldn't talk to me about it. Kept saying, 'I'm not finished yet.' Still, he had some kind of scheme cooking. Every

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now and then when he was out I'd sneak a peek at what he was doing, but it was all technical stuff on staging, theatrics, English history, artificial-being law, air transport, artificial intelligence, business, computers, and android-am-droid bios and mechs. Then, one day when I was particularly hungry, the New York PD called for recruits—"

"You saw how much police recruits were being paid," I interjected.

"Yeah, well, my stomach and I had a talk, and I entered the police academy. Training took up all my time, the work was interesting, and they kept me running as a probie. I lost track of what Archie was doing. My police probationary period eventually ended, I was assigned to a precinct patrol unit, and then I met a girl."

My eyebrows went up.

"No. Her name wasn't Daisy," Shad responded with a modicum of heat. "Her name was Shondelle." The duck glanced out the side window at a break in the clouds which revealed still more clouds.

"Archie was my best man when I married her. When I moved out, Archie moved in with another starving actor, Miles Bowman. I got to know Miles a little, but a year later both of them moved back to England. By the time I made detective, Archie and I had lost touch altogether. A couple years later, right before I was killed, Houndtor Down Hunts hit the media, fox hunting was back, and Miles Bowman was big news, filthy rich, and married to the daughter of an earl. But no mention of Archie Quartermain."

I glanced at Shad. "You suspected something?"

"Sure. I sent a message to Archie and he eventually sent back his thanks but no thanks for the attempted rescue. According to him, everything was going according to plan. I did a little checking on my own and found out why Archie wasn't getting any billing. He's a *really* silent partner in Houndtor Down Hunts. Archie Quartermain is the fox."

"You're joking."

"No. See, he copies his engrams before each hunt. If he wins he wins, but if he gets killed, he's copied into a new bio cloned from his previous meat suit. It's really not as grim as you might think."

"Perhaps I'm making too much of being torn apart by a slavering pack of hounds."

"He never remembers getting killed, see? When he does get killed, the set of engrams copied before the hunt are imprinted into the new fox suit and the new fox inherits but doesn't remember."

"But he knows he's going to get killed."

"Archie told me it's like getting a knee operated on, except when he wakes up from his procedure it doesn't hurt."

"It still strikes me as rather a punishing way to make a living."

"You've never been an actor, have you?"

"No."

"Take my word for it, boss; there are roles to kill for and roles to die for." He gave a duck shrug. "Besides, win or lose, Archie's take per hunt is close to three million."

"Per hunt?"

The duck nodded. "Each of the followers pays thirty thou or so to ride to the hounds, and there are eighty to a hundred or more per hunt, but that's not where the real money is. The big cash cows in the fox hunting racket are the tally-hovers: air hover pods that follow along the route of the hunt, giving their passengers all the thrill and excitement of the hunt without the need of learning how to ride or risking any jumps. Tally-hover seats run three thousand per, which includes the virtual of the hunt complete with the purchaser's face and body CGI substituted for the scarlet or black coat of his or her choice, and the entire ride experienced from the point of view of one of several riders."

"How many of those tally-hover seats

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do they fill on an average hunt?"

"Thousands."

"Astonishing. I find it difficult to believe that anyone would pay that much for a bit of a thrill ride that can be excelled by any number of virtual computer games."

"Ah, that's where you're wrong. See, inspector, it's not just the thrill of a dangerous horse ride and the challenge of ganging up with hundreds of hounds, nags, and snobs to chase down and kill a small dog. What you also get for your money is to be seen at the opening tea ceremony and other refreshment stops along the route, dabbing lips and raising pinkies with such luminaries as Lady Iva Bowman and Lord Peter Talmadge. Talmadge is the hunt's paid snob draw. There's also an old rock star and an old movie star as draws for the upwardly mobile Lumpenproletariat who crave an association with fame. Archie Quartermain has fifty percent of the company. I'm betting he's the richest fox in the world."

"And the dottiest." I frowned as I thought of something. "Does Lady Iva inherit Miles Bowman's interest?"

"Unless she's found guilty of murdering Miles."

"If she doesn't inherit, who does?"

"They don't have any children, so Archie gets it all. Interesting, no?"

"To say the least." I turned toward Shad. "None of which explains how a New York City cop wound up being a duck in Interpol's Artificial Beings Crimes Division."

"This is where I bare my soul, right?"

I held up a hand and dropped it to my lap. "Not a requirement. A desire to understand."

"In that case, I'll tell you. I think I said I was wounded in the line of duty."

"Actually, you said you were killed."

We began descending from the Bovey Tracy Roundabout. "I was backing up some guys taking down a perp. The next thing I knew all the bullets in the world were headed in my direction and I was fricassee. When I came to, my engrams were in memory, Shondelle was pounding on my keyboard demanding to know where the car keys were, and I get a call on my modem from my agent wanting to know if I'd be willing to have my engrams imprinted on a mechanical shark for a remake of *Jaws* that was going into production."

"You agreed?"

He faced me with an expression of astonishment. "It was *Hollywood*. *Jaws*. With a role like that in my credits, who knows what other roles I might've been offered? That was when my agent changed my name. He figured a shark named Donald Lipper would be hard to take seriously."

"Your given name is Donald?"

The duck leveled a rather menacing gaze at me. "Don't go there, man."

"What about your wife?" I asked, judiciously changing the subject.

"Shondelle," muttered the duck. "Even though I explained what a huge break this would be for us, she took a walk. With the bread I could've made from a production like *Jaws*, I could've had my engrams imprinted on a six-figure bio of anything or anyone she wanted. No dice, though. The first person she called after she left my terminal was a divorce shark."

"My sympathies. What happened regarding the remake?"

"What else? *Jaws* bit it. I was about ready for a karma transplant. A week later, though, my agent came through with a pretty good commercial gig. It was a role that before had been limited by computer-generated imaging and trained animals. They were finally ready to move up to a real actor."

"What was it?" I inquired.

"Spokesentity for an insurance company."

Shad saw my expression.

"Yeah. That's the one. Really. That's me."

I frowned at him. "That duck was white."

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"Make-up," Shad explained. He looked forward as our descent crossed the edge of Dartmoor, vast expanses of hilly bracken and grassland interrupted by rocky tors all beneath a gloomy sky. "Good years of really great physical comedy. I was on all the talk and game shows. I was the duck who turned the world on to disability insurance. But then the company was taken over by another insurance outfit. The new bunch wanted to use their own mascot: a creepy little computer-generated lizard, the same old animation they'd used for fifty years."

"Unfortunate. I really enjoyed your commercials, Shad. Very amusing."

Shad shook his head and angrily padded on the seat from one webbed foot to the other. "Treat me like some CGI that'd gone out of style. *Me!* I put life in that duck. I brought new dimensions to that role. I was the one who made that company a household name in every palace and hoodoo hutch on this planet. That's what dedication, hard work, and loyalty get you: No severance, no residuals, out with the old letterheads." He took a breath and let it out. "Anyway, alone, out of work, and no prospects, I went to the International Police Benevolent Association and invoked the 'still living and able' employment clause. They either had to put me on pension or find me a job in law enforcement."

"So they sent you to ABCD."

"First I was with Northern New England Wildlife Protection investigating duck hunting violations. Lucky I had this connection with Archie Quartermain."

"Oh?"

"Whether it's illegal to shoot a wildlife officer who's a duck during duck hunting season really hasn't been settled yet."

"I see what you mean."

"Besides, I had a supervisor who was an eared grebe. That's a bird."

"I assumed it was either that or an illegal wrestling hold."

Shad gave my joke a truncated pity laugh and continued, "Dudley Baumgartner. A small bird, he had a big black crest and these flaky little golden ear tufts he was really proud of. He could've been an American bald eagle, but BioDyne couldn't legally recode the bald eagle DNA to give him black head feathers."

"Why on earth would he want that?"

"Baumgartner was very sensitive about hair loss."

"Eagles don't have hair."

"Tell it to Baumgartner. Red eyes, his voicebox implant programmed to talk like a frog—I'm telling you, boss, this case is saving more than my life."

"Speaking of programmed voiceboxes, Shad, why do you use this duck voice? I mean, it's still rather comical."

"This was the voice that made me a star."

The cruiser came in over the village of Leighon and up a gentle rise to a wood of oaks, maples, and conifers at the eastern foot of Hound Tor. In the center of the wood was a clearing, and in the center of the clearing, at the intersection of a maze of bricked paths and boxwoods, was the grand lodge of Houndtor Down Hunts, a city within a palace made familiar by countless posters, post cards, vid story settings, skyvault projections, and telly commercials.

A circular drive only slightly smaller than the M-5 ran from the front steps to an improved road that lead north toward Manaton. Most of Houndtor's clientele came in by air. The huge skydock was south of the lodge. The dock appeared to have parking slips for only a few hundred vehicles, but as we came in over it, I could see the access lanes to additional parking slip floors below ground level. As we descended onto one of the multiple landing targets, I noticed with some alarm that Shad was shaking his tail feathers back and forth. "I say, Shad, do you need to go to the loo?"

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"What?" He glanced back at his own shaking tail. "Oh." He dismissed my concern with another wave of his wing. "Updating my anti-virus definitions."

Despite the promised rain, the gardening staff was out in force, clipping, pruning, weeding, and such. No one else, staff or guests, seemed to be about. Of course, the promised park constabulary vehicle and driver were absent, which was a dual problem for us since the ABCD charter requires us to turn our case over to the local authorities in the event an arrest is to be made. The missing fellow, in addition, was supposed to bring us to the scene and copy us the park constabulary's case file. "Typical," I muttered as we exited the cruiser. "A thing you'll notice during your time with ABCD, Shad, is that, as you Americans say, we can't get no respect."

"Let me see if I can scare up our ride," said Shad, pointing his right wingtip up at the sky.

"You can fly?"

"But of course." He took a running step, furiously flapped his wings, and took off low across the ground, gradually increasing his altitude in an ever-widening arc to the right. Quite beautiful, really. Almost completing a circuit of the clearing, south of the skydock he dropped from the sky like a hawk, disappearing into the trees below. This was shortly followed by rather loud duck calls, and the whine of an electric energizing. In moments a green and white park constabulary electric emerged from the trees, my partner perched triumphantly upon its light array.

Park Police Constable Lounds was a lethargic lad about fifteen stone, dark-complexioned, and keeping both head and face hairless. Clad against the anticipated precip in a constable's yellow anorak, he appeared to be torn between his affected contempt for the "Interpollys," as local police are wont to address ABCD investigators behind their backs, and his actual esteem-crushing shame for being so terribly low in DCI Stokes's estimation as to be the one detailed to meet with us. His eyes were puffy and there was a bit of dried drool on the left side of his chin. Lounds had been napping. He pulled his desktop from his belt array and transferred the current Miles Bowman murder casebook to my portable. We boarded the vehicle, Lounds in the driver's seat, I in the passenger seat, and Shad up on the light array. Lounds drove us to the scene following a route marked by numerous hoof impressions. I noticed carefully hidden motion cameras and sound pick-ups in several places along the way. It appeared as though the vid director and those manning the cameras and audio for the tally-ho virtuals knew exactly which course the wily old fox would take during the hunt. Probably all the details had been worked out with Archie Quartermain prior to the meet where the followers joined the hounds, tipped their hats to the Master—now deceased—and sucked down the first of several libations offered along the way. Call me old-fashioned, but the fox being in on the planning of the hunt seemed to take at least a bit of the sport out of the thing.

The route Constable Lounds took led around the ends of several hedges and fences, none of which enclosed anything. They were placed there, obviously, to provide the mounts and riders barriers over which to jump.

Eventually we crossed sheep-grazed grassland up a moderate grade to the left of Hound Tor, a magnificent citadel of weathered granite towers, a motorway-wide notch through the center of which became visible once we crossed the crumbling remains of an old asphalt road and reached midway between the lodge and a grove of conifers near the crest of the down. "Scene's up there," said Lounds.

I faced him and saw he was nodding

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toward the pines. I noticed my partner flying on ahead of us, soon disappearing behind some trees. I took a moment to look at the case file, but could find nothing in it referring to an interview with Archie Quartermain. "Are you familiar with this case file, Constable?" I asked Lounds.

"Read it twice waiting for you and your feathered friend there, guv. Fact is, I was first responder here." He shrugged resignedly and stifled a yawn. "Been here since."

"All night?"

"I was supposed to get relieved, but some bloody cock-up left me carrying the can."

"I don't see any interview with the deceased's business partner, Archie Quartermain."

"The fox, y'mean, guv? He's in a hole somewheres."

"No one's seen him?"

Constable Lounds tapped his own portable desk in its holster. "Only address Quartermain's got's here at the lodge. He don't have a room, though. No room and hundreds of millions in the bank."

He parked the vehicle, we got out, and crossed the tape. There was a lane through the grove made by the trees being thinned to where no two of them in the path were any closer than six meters from each other. The trees themselves were Quik-gro pines, the vegetable kingdom's twenty-meter-tall answer to Quik-gro human and amdroid meat suit bios. The tree branches throughout the entire wood had been trimmed to four meters plus from the ground. Within the confines of the path, then, there was an intermittently clear view from above, allowing the tally-hover spectators to follow the riders with their eyes and cameras, with no one actually riding to the hounds being more than a second or two out of view from someone above. Off the lane, however, the view from above was completely blocked due to the closeness of the trees. The yellow tape placed by the scenes of crime officers enclosed part of the lane but extended deeply into the off-lane trees.

"We got the vids, guv, both the lodge's and from the folks up in the hovers."

"Did anyone catch the actual killing on camera?"

"Not a one. Bowman got his in the thick of it." Lounds pointed a finger toward our left. "Trail vids got Miles, his missus Lady Iva, Huntsman Diana Weatherly, Lead Second Horseman Sabrina Depp, the head whipper-in Thomas Flock, his nibs Lord Peter Talmadge, and that old West End actress Dotty T. off the main track here."

"Dotty—Dorothea Tay, do you mean?"

The constable grinned. "Grand old lady. She got 'er a meat suit'd break your heart, guv." I couldn't help but smile. Dorothea Tay, my childhood fantasy love from afar. I had seen all her early plays and I still had the vids of all her movies. PC Lounds's face grew troubled. "DCI Stokes told me you're Interpollys and you're not to make arrests. That's my job."

"We are aware of the regulations." I nodded toward the deep woods. "What do you think, Lounds?"

His bunchy little eyebrows arched. "Me?"

"You've read the file, you're a trained police officer, I'd like your take on it."

"Well, guv," he began, slightly surprised at being asked, "only ones I know bring horseshoes to a fox hunt is horses."

"Constable Lounds, you will be pleased to hear that my superintendent agrees with your assessment. Do you know why your DCI Stokes discarded that theory?"

Lounds looked very uncomfortable. He glanced up at the still darkening sky, then shifted his gaze to me. "Off record, inspector?"

"Of course."

He pursed his lips and nodded once.

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"'Titled Lady Croaks Multimillionaire Hubby In Grisly Slaying' makes a juicer headline than 'Horse Kicks Rider.' "

As we walked deep beneath the cover of the trees off the lane, I could see a laser marker perhaps ten meters ahead. DS Shad came flying the other way, his landing pattern weaving between a succession of tree trunks, the touchdown right before us—a competently executed maneuver. Shad waddled over and said, "Not much left. What hasn't been taken away or trampled into the pine needles has been picked over by the wildlife."

"Can you make out where Bowman's body was found?"

"They have a Vader prang in place, but I didn't run it up." He nodded toward the cleared lane. "Notice once you get away from that open run, there aren't any cameras or audio pickups?"

I nodded and followed as Shad lead the way, Constable Lounds bringing up the rear. Once we were next to the tree where the marker was attached, I asked Lounds to activate it. He took out a remote and did so, and a high-definition image of the deceased Miles Bowman appeared in its place on the forest floor two meters west from the base of the tree. He was on his left side, his head pointing southwest, body curled in a loose fetal position. The image was depicted wearing scarlet coat over cream-colored cravat, waistcoat, and trousers tucked into gleaming black riding boots, all of which had been marked with bloody hoof marks, the source of the blood being the deceased's scalp, face, and hands. "Full scan, Lounds," I requested.

Lounds touched the remote and the image expanded to include everything within the prang's line of sight up to ten meters from the unit, which included several pairs of disembodied feet at the periphery: The scenes-of-crime officers awaiting clearance to approach the body. "I don't see Bowman's black velvet riding helmet," I said to Lounds.

"Lady Iva had it in 'er hand, guv."

"Be a good fellow and cycle the SOCS."

The scenes of crime sequence images cycled: Footwear impressions included all of the suspects, including Bowman's horse, as well as all of the other horses ridden by the suspects. A bloody horseshoe had been recovered from the ground near the body, and the shoe had come from Champion's right front hoof. A note: Champion's hooves had all been tested for blood and had come back negative, which would have been remarkable except when Champion had finally been recaptured, the nag was standing with all fours in a spring-fed brook.

I looked up at Lounds. "They didn't test the rest of the horse for blood spatter?"

The constable shrugged helplessly. "DCI Stokes's got 'is bird—" He glanced at Shad. "Beg pardon, Sergeant."

"Forget about it," answered the duck. Shad looked at me.

"Yes. It does appear to be left to us." The beginning of raindrops hitting the needles above us announced itself. I pulled up my collar, took a holoanalyzer out of my breast pocket, and nodded at Lounds.

As he turned off the laser marker, we were momentarily plunged into relative darkness. I turned on the pen-sized analyzer, placed it in the receptacle on the laser marker to steady it, and controlled it with my portable. By default the analyzer first projected the aggregate images: All substances on the tree trunks not actually made of that type of wood. The tree trunks appeared mostly in shades of white and gray speckled with brown, red orange, lavender, and so on.

"A lot o' stuff on them trees," observed Lounds.

"Moss, lichen, animal waste, insects, and insect waste," I said, filtering out the hundreds of thousands of colored speckles. I filtered out the bird droppings, rodent droppings, canine, and feline hair, urine, and excrement, as well.

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"I hope that I shall never see a toilet filthy as a tree," quipped Shad.

There was some equine as well as human blood on the tree nearest where the body had been. The tree was a twenty-centimeter-thick pine standing in front of a deadfall that was well into rotting its way back into the floor of the grove. The human blood was Bowman's. The analyzer DNA-matched the horse blood through the world amdroid database to Champion, Mile's Bowman's horse. There was equine hair, also Champion's. On three other tree trunks was human blood spatter in medium-velocity patterns. That blood, too, was Bowman's.

I ran the spatter forms and sequence, derived the impact angles, and determined the points and order of origin. It then projected a reconstruction of the blunt force impacts, and it was looking more and more as though a horse was our suspect. The blows that were struck, at least six of them, occurred in pairs, in that two blows were struck at a time, and with horseshoes. D. Supt. Matheson couldn't imagine Lady Iva getting into the muck to beat a man to death with a horseshoe. I was having difficulty, frankly, in imagining any human beating another to death, a horseshoe in each hand held such that the flat of the shoe struck the victim each time, rather than an edge, and that three times both hands were employed delivering blows at the same time.

"Guv," said Lounds as he stifled a yawn, "need me?"

"I suppose you could stand a nap. Are all the vids in here?" I tapped my portable.

"They are."

."We have all you can help us with, then, Constable Lounds. Drive us to the lodge, and then you can take the car and go home with our thanks for all your assistance."

After an hour and a half in the lodge's walnut-and-leather-festooned club lounge watching the professional and amateur vids of the interrupted hunt, Shad and I were swamped with useless information. Time and time again we saw the six riders following the hounds as they led away from the thinned lane beneath the solid canopy, then twenty seconds later, all but one returning to the lane and pausing as the foxhounds milled around searching for the scent. The prey, Archie Quartermain, appeared several times during the run. We saw him on stationary cameras coming into the lane through the grove, running along it, and exiting as he raced toward the rise beyond the grove, no one following.

No one caught Miles Bowman's demise on camera. Lady Iva Bowman, indeed, had been the first to return to the spot off the lane, ostensibly looking for her husband, returning moments later with the Master's black velvet cap in her hand to cry out to Lord Talmadge, who was the closest to her. He called to the others, all of whom followed Talmadge and Lady Iva back to where Bowman's corpse was cooling.

Only three of the riders in the party had been carrying point-of-view vid cameras: Bowman, Talmadge, and Dorothea Tay. Miles's POV camera went dark as soon as his horse ran beneath the thick cover. No audio.

Talmadge's camera showed he was ahead of the Master when his own horse turned off the lane to follow the hounds, his camera going dark until he came out from beneath the thick cover and came up behind the staff riders back in the lane, where it appeared the hounds had lost the scent. Talmadge pulled his mount up behind Tay. Weatherly, Depp, and Flock then turned, supposedly in reaction to Lady Iva's call for help. He and the others followed Lady Iva back beneath the solid cover, where the images from his camera were so dark they were almost useless. Talmadge dismounted, then we could just make out the image of Lady Iva standing next

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to her husband's corpse.

After that, we watched Dorothea Tay's POV vid from the beginning, starting with the opening ceremonies, the fields of riders moving off, the casting of the hounds, and then, as Shad put it, "Yoicks away."

It was rather exciting watching the unedited recording. Miss Tay was quite a rider, as were the five persons with whom she was riding, the hounds almost always in view. Glimpses of Miles, Lady Iva, Lord Talmadge, even an occasional glimpse of Archie Quartermain, his white-tipped tail vanishing and reappearing as he led the chase. Midway through the lane of thinned trees, the hounds veered left and ran beneath the solid cover. Miss Tay led the other riders, her camera going dark beneath the dense cover, the images clearing as she returned to the lane.

"If we're to believe these vids," said Shad, "the only ones who could've done in Miles were his spouse and his horse."

"It's easy enough these days to doctor vids, Shad, inserting or removing anything one wants. It still takes time, though, and all those tally-hover amateur tapes seem to back up everything shown by the stationary and POV cameras." I glanced at Shad. "As subtly as you can, see if the park cop SOCOs examined any of the vids for editing."

"Check."

As I returned to Dorothea Tay's POV vid, Shad did his wireless thing. From my end, the call was silent. Shad noted me watching him, and I pointed at my ear. Shad pointed at my portable. "Six-sixty-one," he quacked.

As soon as I opened that particular channel, I was treated to an authoritative and distinguished investigator questioning DCI Stokes of the park cops on the case evidence, and about any testing that might have been done regarding any editing. The voice Shad was using was very commanding, very British, and seemed very familiar. Every syllable simply oozed gobs of absolute authority and withering contempt. No testing had been done, as it turned out, and Shad's voice intimated that having the vids examined for editing would reflect kindly upon DCI Stokes's future, whereas continuing to fail to examine them would likely earn him a posting as toilet attendant to the northernmost of the Shetland Islands.

"Very effective, Shad," I said. "The voice you were using—I know it from somewhere."

The duck nodded. "Laurence Olivier as Marcus Licinius Crassus in the old motion picture *Spartacus*. I find it works very well on most Britaucrats."

While I digested this particular facet of my new partner's sound equipment, I studied a frame of one of the stationary vids I had up on my screen. It showed a red fox: short legs, a long bushy tail, and a narrow muzzle. The creature's ears and feet were black, its tail had a white tip, and the coat was glossy and rust red. I turned and glanced through one of the many tall windows in the club lounge facing Hound Tor. The promise of rain had been fulfilled. "Shad, run the cruiser around to the front of the lodge beneath the portico. I think it's time someone interviewed the fox."

An hour later the rain was falling steadily on the cruiser's canopy a half kilometer south of the lodge grove, giving us a distorted view of the protected site of a nameless medieval village and the large rock formation just beyond it. In the distance, occasionally obscured by patches of ground fog, rose the imposing heights of Haytor Rocks. Had the village been located in the American southwest, it would have been called a ghost town. It was little more than lanes, foundations, and the occasional restored wall, with a small imitation stone, prefab National Park Information Center sporting a pseudo thatched roof and pseudo brick chimney at the site's northwest corner, with a rather real-looking sparrow perched on its top.

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Shad had posted a wireless text message for Quartermain and when the fox answered, this was where he said we were to wait. Putting the waiting time to use, Shad checked with the District AB Registry for the particulars on both Archie Quartermain and Miles Bowman's horse.

"Both amdroids were gestated, grown, and activated through Fantronics, Ltd. out of London," said Shad. "The bio amdroid assignment supervisor there, Dr. Shirley Wurple, dodged my call. Her chief assistant to the assistant chief, one Martin Corbola, says he would be happy to answer all of our questions—once we present at the Fantronics legal offices, during normal business hours, a duly sworn and signed warrant for the information on Quartermain." He faced me. "The information on the horse, however, he gave up willingly."

"Horse engrams can't quite grasp the concept of litigation, I suppose. Have London ABCD apply for a warrant for Quartermain's records and post us with the names of any Fantronics employees connected with Quartermain's transformation into a *Vulpes vulpes*."

After sending in the warrant request, Shad said, "Where were you before you wound up in ABCD?"

"Metro. London Metropolitan Police."

"You mean, Scotland Yard?"

"Just 'the Yard.'"

The duck studied me. "So, you were a big-time murder cop in *the Yard* and you wound up out here in West Mudflap doing grunt work for Artificial Beings Crimes . . . *how?*"

"What about you? How come you're still a duck? The International PBA pays for human meat suits for fallen officers."

"Have you ever seen those generic bios they use in the States? One size fits all. They don't come with wireless modems either."

"Also they don't fly," I added.

"There is that." He nodded. "The flying is one reason I'm a duck."

"I hear for many ams it's the sex."

Shad faced me as his eyes widened. "Are you kidding?"

"Not at all. Many species of animals have better sex than humans, I understand."

"What—did Parker tell you that?" The duck laughed with a repeated *wak, wak, wak* sound. "*Better* sex? Ignoring the really severe seasonal limitations for most waterfowl, have you ever seen ducks copulate?"

"I can't say that I have."

"No matter how you slice it, man, it's criminal sexual assault."

"You mean rape?"

"I'm not exaggerating." He shivered all over. "In Duckville, man, if you don't do it like that, you don't do it at all. I can't do it that way. It is one big stone cold turn-off."

"Then why don't you opt for a human meat suit?" I insisted.

"Look, when I was working for that insurance company, part of the deal my agent put together was quite a sophisticated package for their spokescritter. This duck is loaded: ENN-band wireless interface, portable engram reader, all-weather thermal imaging, state-of-the-art sound, a memory bigger than the Library of Congress, disease-proof, and mildew-resistant. As long as I don't get shot by a hunter, sucked into a jet intake, or caught by a chef, I'm practically indestructible. But it's not just that I'd have to give up all those features to put on one of those Mediocre Myron meat suits to become a mere mortal human back in New York's finest. What would happen to me—I mean, what would happen to the duck?"

"The meat suit would be put in the queue for whoever wanted to become a duck."

"That line doesn't exactly wrap around the block. I'll tell you what would happen: This little duck would be allowed to die, its mind emptier than my pension plan. This duck made me a star, put my name in *Variety*, and got

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me my own booth at Billy Bob's Buffalo Burger. I owe it more than letting it wind up in a recipe or a landfill somewhere."

"The lovemaking, though, Shad. Do you miss it?" I almost regretted asking. Each question is, in its own way, a confession.

Shad stared at me for a second. "Sure, I miss it. About a year ago there was this hooded merganser I met on a landfill in Skowhegan, Maine. Cutest little tail you ever saw."

"How is a mallard attracted to a hooded merganser? Doesn't that violate some sort of law of nature?"

Shad waved a wing, dismissing the question. "Every year in New England some moose comes out of the bogs and falls in love with a dairy cow, and I'm talking real moose and real cows. You do realize I'm not a real duck, don't you?"

"Pardon me if I seem a bit dense, Shad, but it seems even more perverse for a human to be sexually attracted to a hooded merganser."

"You need to walk a mile in my webbed feet. Besides, you never saw her fluffy pink and white pinfeathers. Your theory works the other way, though. She wouldn't give a mallard a second look." He faced me. "I still haven't forgotten my question."

I stared at the rivulets of rainwater streaming down the canopy. "About three years ago my wife died. It was in some sort of building explosion. Killed seven others as well, including the bomber."

"Religious nut?"

"Insurance scam gone awry, as it turned out. The fire brigade's paramedics managed to harvest my wife's engrams before she went neutral." I smiled sadly, recalling her reaction when she regained consciousness in the generic female bio the National Health and the IPBA had provided. I glanced at Shad. "She called her bio Averill Average."

Shad only nodded, his gaze fixed on some inward quandary of his own.

"My wife had many health problems: chronic headaches, arthritis, difficulties with her heart—"

"None of which Averill Average had," completed Shad.

"Quite." I let out an involuntary sigh. "She was so healthy I imagined it would be for her like being born again. To be honest with you, Shad, generic that female bio may have been, but I found her rather attractive."

"Built, huh?"

I felt myself blush. "Well . . . in a word." I glanced at him. "That notwithstanding, my wife couldn't stand her new body. She saw a therapist and all the rest, but I'm afraid she had some rather severe issues that were brought to full flower by inhabiting what she considered someone else's body, although hers was the suit's first imprint. We explored the possibility of doing a Quik-gro bio from her own DNA, but the NH and the PBA wouldn't cooperate because of her DNA's built-in health problems."

"Policy," remarked Shad.

"Indeed. The short of it was that she wanted out."

"Suicide?" asked Shad.

"No. She wanted out of Averill Average. She wanted a new meat suit."

"How? The union wouldn't spring for a second body—particularly not a designer suit. Those can cost millions."

"As it turned out, she didn't want a human bio no matter who it looked like. Valerie traded her human meat suit on eSwap for an automatic dishwasher, ten years housekeeping service from Rent-A-Mech, and an amdroid meat suit. She had her engrams imprinted on a female cat bio."

"You're married to a cat?"

"A Tonkinese. We're still together, of course. I love her very much."

The duck let out a snort of frustration. "Great. Neither of us are getting any."

I burst out with a laugh at that.

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"Quite." I looked over at him. "Regarding your question, I'm on my second bio myself. Between that and my experience with Val, I qualified for ABCD." And now came the difficult part. "Perhaps my work at the Yard was slipping. Set in my ways. I'd been a detective for almost sixty years. Perhaps Metro just needed to clear the upper ranks in order to bring up deserving youth. Whatever. Since I refused to retire, I was forced to take a position with ABCD."

"Yeah," said Shad as he nodded. "Now I know who you remind me of. You sort of look like Basil Rathbone."

"I noticed the same resemblance in this bio. I rather like it. How does one so young remember Rathbone?"

Shad placed the back of one wingtip against his forehead. "Surely you jest. Basil Rathbone, big star in the nineteen forties and fifties, his Sherlock Holmes films still on the B&W vids all the time."

"Ah, yes," I said as I recalled. "'Guard this with your life, Watson.' He was an early Sheriff of Nottingham, as well."

"The Sheriff of Nottingham was a brother officer who got a bum rap from a biased media," Shad observed, then held out his wing. "So, what happened? Did you get killed?"

"The first time. The second time there was a genetic glitch in the bio that resulted in rather debilitating health problems. The IPBA insurance covered bio replacements both times, and Valerie insisted I take this one."

"What happened to the old you?"

"The first was ransacked for body parts with the remainder cremated and scattered in Val's garden—back when she used to garden. The second one, believe it or not, is still alive and in the nick up in North Yorkshire awaiting trial for multiple murders."

"G'wan. North Yorkshire? The old you is the Harrogate Slasher? Chucky Bulvine? The guy who used a portable engram assignment unit to steal an identity to disguise himself for his nighttime murder sprees?"

"That's the one. Some terminal pensioner from Otley took on my old body thinking he might get an additional four or five severely limited years out of it for next to nothing. Then one night Chucky Bulvine caught him, wiped him, did a swap, killed his first victim, then reassigned back to his old body. He kept that up, using my old body, then reverting to his usual self between killings. He might never have been caught except Bulvine's ex-wife found his body in stasis when he was out in mine and put a plastic bag over his head. By the time he returned, his old self was covered with flies."

"So Bulvine's stuck in the old you."

I couldn't help but smile. "The old me simply wasn't up to running from the police."

"Too much cop in your DNA."

"Mostly a weak heart and a pair of bad knees." I grinned as I added, "Quite a dilemma for Bulvine, though."

"How so?"

"Bulvine's best legal strategy is to drag things out until the crown's aged chief witness either dies or can be frightened off. The doctors, however, don't think the old me can possibly live another six months. Quite a predicament."

"That's the future," Shad remarked laconically. "What a fascinating modern age we live in."

I grinned as I pointed at the duck. "Lucky Jack Aubrey in the vid remake of *Master and Commander*. Right?"

"You know your flicks. In the *Master and Commander* remake, do you remember the flightless cormorant the doctor saw when the *Surprise* made the Galapagos Islands?"

"Of course."

The duck crossed his right wing across his breast, held out his left wing and did a courtly bow.

"No," I said. "I don't believe it—"

A tapping sound came from Shad's side of the cruiser. He straightened from his bow and looked down through his side of the canopy. "We better copy into

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the mechs, boss. It's Archie Quartermain, and right now he's going into a muddy hole in the ground."

"No. Impossible. I cannot believe Ida killed Miles," said the fox.

Archie Quartermain paced back and forth, looking about warily in what passed for his office. The site of the medieval village below ground level was a warren of tunnels and chambers, many of the chambers being old hidey-holes formed from the village's remaining root cellars, wells, and cisterns. The stone slab chamber in which our meeting took place was a little over three meters by two and contained an occupant other than Shad, Quartermain, and myself: a human skeleton.

While our meat suits reclined in the cruiser, hovering prudently out of reach of local malefactors, Shad and I were in the mechs. Mine resembled a tread-mounted aluminum grapefruit topped with miniaturized vid, lighting, audio, and analysis equipment. Shad was in the fist-sized hover mech, which resembled an art deco Saturn with a badly straightened set of rings. The only illumination in the chamber was provided by our mech lights. While Quartermain paced, I did a quick carbon on the skeleton to see if it was something I needed to ring in. It wasn't. The bones dated back to the thirteenth century. Judging from the earthenware jug next to the bones, the likely cause of death was slow suicide. From his own mech, Shad tuned into my test data and responded with a signal inaudible to the fox, *"Talk about your cold cases."*

"I don't understand any of this," Quartermain said. "Miles and Ida Bowman are—were the love story of the century. Besides, Miles was a bear of a man. Strong, muscular, good in a scrap. Ida was half his size. Beat him to death with a horseshoe? Rubbish." He stopped suddenly and looked at Shad. "The run was all wrong. Have you looked into that?"

"What about the run?" asked Shad.

The fox glanced warily at the hover egg. "It didn't follow the planned route, did it, Don? The hounds and horses were supposed to follow the glade lane through Quik Grove. Have you seen where Miles was found?"

"Yes," responded Shad, "but the horses follow the hounds, and the hounds follow you, right?"

"Not that time. I zigzagged down that lane and never got off it. Suddenly all the hounds were gone." He looked at Shad. "You have GPS and wireless in that mech?"

"Yes."

"You'll see. The run was all planned out in advance, down to the last turn." The fox sat, his tail around his legs, hunched his head forward, and bared his teeth. "I'm sending you the plan, as well as the performance record. I hit every mark exactly, in sequence, and on time." The fox glanced at me. "We use the records to debrief the staff after each hunt."

"Why?"

"Constant improvement at Houndtor Down, inspector. Identifying weak areas and mistakes, sharpening up the challenge, polishing the act."

My partner nodded. "Got it, Archie."

"My run was cut short at the first turn, after leaving the grove. That's when I noticed none of those hounds were dripping hot slobber in my dust." The fox froze for an instant, then fixed me with a beady-eyed stare. "I have a built-in image reader in my package. Once I realized something had gone wrong with the hunt, I tuned in and peeked through Champion's eyes. He was the only amdroid in the leaders. Miles's horse was already out of the grove, running down toward Becka Brook. Champion's emotional feed spilled into his vid. I was sure something terrible had happened. I didn't find out what until I was back in my den and tuned in the message Sabrina Depp posted for me."

"About Miles's death?" I asked.

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"That, Lady Iva's arrest, and that the police wanted to talk to me. It's simply all so preposterous. Iva couldn't have killed Miles. You've got to get to Champion and download his recall bank."

"When you tuned in Bowman's horse, what did you see?" asked Shad.

"A scramble of terrible images." He thought a second. "A horse hit by a lorry hauling toilets, horses horribly wounded and killed in a desert, horses falling and being blown apart by cannons—all of it at once, filled with deafening pain and panic." The fox looked at me. "It was like looking at a horse's nightmare."

There was a scuffling sound, movement beyond the old bones. Quartermain jumped over the skeleton and vanished from view. Shad and I aimed sensors at each other. He dipped his front ring and whispered, "Recognize it? The horse hit by a truck hauling toilets?"

"Yes," I answered. "*Lonely Are The Brave*, Kirk Douglas and Walter Matthau, nineteen sixties."

"Nineteen sixty-two. The desert thing might be from an old vid called *Hidalgo*," he suggested.

"Horses dropping and being blown up could be from any of the old movies centered on the Crimea or the Napoleonic Wars."

"*Charge of the Light Brigade*, Errol Flynn," said Shad. "I'll see if I can tune in Champion."

I tracked over next to the old bones and saw that beyond them was an opening between two of the foundation rocks that led to a burrow. I swiveled my sensor array in Shad's direction. "Any luck with the horse?"

"I can't get through."

"Put it off for now. I want to know the layout of all these burrows, Shad, and I want the mapping to be unobserved. Go on up to the cruiser and transfer over to a micro."

"Man," he muttered. "The last time I went out in a micro I was swallowed by a grouper. You have any idea of the disgusting things fish eat?"

"Soon."

"Yes sir," he answered with a sigh as he turned and flew out of the chamber the way we had entered.

I looked back at the skeleton. Archie Quartermain was skulking behind the ribcage. "My mate," he said furtively. "Brought me mouse." He licked his chops, panted for a brief moment, then said, "Still warm."

"Steady," I cautioned.

"She's pregnant."

I was left speechless for a moment. At least foxes were getting it on. "Well, congratulations, you sly old . . . Congratulations." Time to return to the investigation. "Tell me, Mr. Quartermain. Where do you keep your body in stasis?"

"Body?" The fox paused long enough to glance at the floor and shake his head. "This is my body now. Don't keep anything in stasis."

"Well, what about your human body? Where is that?"

"Sold it. Seed money for the operation. Brought a good price. Ask Don. Archie was a young handsome fellow in good health. Brought almost two million."

"Mr. Quartermain, I have to ask about your own possible interest in your partner's death."

"Mine?"

"If Lady Ida is found guilty of Miles Bowman's murder, you stand to inherit quite a respectable sum; not to mention a very lucrative operation."

"Money. That's what you're talking about, isn't it? Money?"

"Of course."

The fox began pacing again, his nose sniffing at the chamber floor. "Mice," he said as though to himself alone. "Mice are important. Mating, grubs, grass, eggs, gates, cubs, fast-fast legs, and chickens are important. Money: that's paper." He abruptly turned and fled through that opening at the rear of the chamber. "The game," he growled huskily as his voice faded.

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"The game is all!"

Archie's soliloquy on priorities concluded, I tracked out of the muddy burrow and called down the cruiser. Shad was in it just completing his transfer to the micro, a flat-black colored hover vehicle resembling a stealth lipstick, one end encrusted with instruments. After hosing out the mech, I went back to my meat suit and Shad darted off to map the burrow system. While Shad was occupied doing that, I went to the lodge.

As evening approached, making everything dismally dark as well as wet, Shad and I were back in the cruiser, the vehicle parked at the skydock, our engrams back in our current selves. Shad was labeling the GPS tunnel map he had made. That done, he leaned back from the screen and said, "So, while I was grubbing in the dirt, you did a tour of the palace?"

"Yes."

"So? What was it like?"

I thought for a moment. "Good taste and great vision meet big money and unlimited energy."

The duck faced me and said seriously, "That sounds like approval."

"I confess, Shad, I was prepared to view the whole place as outmoded values wallowing in unlimited wealth, but it is quite well done. All the halls, rooms, great rooms, and the shopping center are stunningly beautiful, and the service is prompt, polite, and practically invisible. Did you know there are hunt clients and their families that live there all year?"

"Service?"

"Why, yes. I had a cream tea at one of the shops in the mall."

"Cream tea," he stated flatly, that hint of menace sharpening his tone just a trifle. "I don't suppose the place was set up to entertain ducks."

"Actually, the shop had a fountain, and there were ducks entertaining themselves in the fountain's pond. They appeared to be enjoying themselves, but who can say? Ducks are so inscrutable." I glanced at him to see if he was properly steamed, but he was onto me.

His bill was open as he emitted a low laugh. "You're one of those people who believe that life is a test, aren't you?"

"How did you find your old roommate, Archie? Different?"

His demeanor grew serious. "You notice how Archie kept referring to me as Don even after I told him my name was Guy? He's in some kind of weird zone."

"I'm afraid your old roommate's gone a bit native, Shad. He said his mate has cubs on the way, and you should've heard his paean to a plump warm mouse. He said something strange to me—"

"You mean other than liking Mickey sushi?"

"He was telling me what was important to him. He ended by saying, 'The game is all.' Does that mean anything to you?"

"The game is what we used to call live theater." Shad thought for a moment. "That's what he's doing now, isn't it? Live theater?"

"He's not after money. In fact, Bowman's death jeopardizes everything Archie Quartermain currently holds dear, doesn't it?"

"The same could be said for Lady Iva, boss. Miles might have been getting a little on the side from Sabrina Depp, but take my word for it, Sabrina had to have been only the latest in a long string of honeys. That's the way Miles always was. Anyway, if you are Lady Iva and want to protect hearth and home against a homewrecker, who do you kill?"

"The other woman," I answered. "And, if you want to get revenge on a rich, philandering husband," I continued, "who do you see? A hit man or a lawyer?"

"Ninety-seven point three percent of prospective vengeance wreakers go for the court shark," responded Shad. He

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looked at me. "It's time to see a horse about a man—a dead man."

"I agree."

After leaving the cruiser in an unused loading dock, Shad and I were standing in the antechamber to the complex, a space reminiscent of the hanger deck of an aircraft carrier. Very big, very white, with technical, mechanical, and horsy looking personages hurrying this way and that at the direction of automated panels festooned with blinking lights and glowing indicator bars. The air in the space carried trace scents of paint, prepared foods, hot electrical boards, polished leather, hay, and horse manure. Directional signs pointed to various wings in the structure. In one, tally-hovers were being repaired, cleaned, polished, stocked with refreshments, and stored for the next hunt. In another wing were the vid studios sectioned into units that operated and repaired vid and sound systems, viewed, edited, and "supplemented" vids with complete sound stages and computer animation facilities. There was a third wing in which mechs of animals and other appliances were programmed and maintained—it seemed a significant portion of the birds singing in the treetops, as well as bunnies munching leaves along the paths, were mechs. There was a complete hospital wing capable of handling most human and animal illnesses, both natural and bio. The last wing was where the operation kept horses, with stalls for two hundred of Houndtor Down's horses and another three hundred guest-leased stalls. There were two barn-sized rooms attached to the wing for feed and other supplies, and a third barn-sized area that contained offices, tack rooms, employee lockers, and changing rooms, and a full-sized indoor riding paddock. The hounds, we were informed, had their own separate kennel complex. All of this because at some point back in prehistory, some farmer got fed up with foxes eating his chickens.

Diana Weatherly, Huntsman to Houndtor Down Hunts, joined us in her office, which was richly appointed with a walnut desk, brown leather overstuffed chairs, and liquid crystal walls that currently showed striking views from the top of Hound Tor, but on a sunny day. Weatherly was in her middle forties, good-looking in a sturdy sort of way, and gave the impression of being quite fit. As she sat in one of the overstuffed chairs facing us, she was wearing a buff suede jacket over a black blouse and black skintight lowers, the cuffs tucked into highly polished brown riding boots. From the records we knew that Weatherly had been Master of Horsham Hunts out of Manaton, a much smaller and much less successful operation than Houndtor. When they were starting up Houndtor Down, Miles Bowman and his fox of a partner sold Archie Quartermain's old self and used the proceeds to make a down payment to buy out Horsham Hunts. Once they closed, Bowman, Quartermain, and Weatherly moved the entire operation to Houndtor Down, Diana Weatherly becoming the operation's Huntsman, responsible during the hunt for controlling the hounds through three whippers-in, the lead whipper-in being Thomas Flock.

"Didn't Bowman run you out of business?" the duck pressed.

She actually held her hand to her mouth as she giggled. "You're a queer duck."

He stared at her for two seconds. "Nevertheless."

"If you insist, ducks." She then laughed out loud with sufficient zeal and abandon to raise her exhibition to the level of wanton guffawing. Calling a duck "ducks" somehow struck her as the absolute zenith of wordplay wit. Once she regained control of herself, she said, "When I was the Master of Horsham Hunts, ducky, I was up to my

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ears in debt, only a step ahead of my creditors, and literally didn't know from where my next meal was coming. Thanks to Miles and Archie, I ride to the hounds at least three times a week, drive a Steel Gazelle, vacation wherever I want, live in my family's ancestral home—all taxes and debts paid—and I'm earning per year sixteen times the amount I earned the best year I ever had at Horsham. I haven't even mentioned the stock sharing plan, which brings in as much as my earnings. I wouldn't have to be ungrateful to resent Miles. I'd have to be insane." She glanced at me, a bored expression on her face. "Anything else?"

"Could we see Champion?" I asked.

"I'd say it was about time," she said coolly as she stood.

We followed Diana Weatherly out of her office and the duck said to me out of the corner of his bill, "'Horse Throws Rider.'"

"For money, ducks?" I asked with a smile.

Shad glanced in my direction, studied me for a moment, then shook his head. "You're being sneaky. What do you know that I don't?"

"Five dimensions to a case, Shad."

"Left-right, up-down, in-out, time, and . . . what?" he asked. "What's DI Jaggers's fifth dimension?"

"The fifth dimension, dear fellow, is this: chances are the murderer—if indeed a murderer there is—has looked at and considered the other four dimensions much longer than the investigators, and with a lot more at risk."

"Staged?" whispered Shad as we entered the cavernous hall of the operation-owned horse stables. "You think there's a killer, and the killer staged this to make it look like the horse did it?"

I pointed toward Diana Weatherly's rapidly receding back. "Let's see the horse and find out."

Miss Weatherly left us inside Champion's spacious stall with instructions to call one of the grooms or attendants in the area if we needed anything. The horse was a largish, glossy, black Arabian. He had a handsome face with a pure white patch in the center of his forehead. The source of the hair and blood from Champion found on the tree at the scene was a deep scrape high on Champion's left shoulder. "I'll check him over, Shad. While I'm doing that, give Champion a scan and see if you can access his memory."

I passed the analyzer over the horse's body and legs, checking principally for blood. I found a good bit of medium-velocity spatter on his chest and the front of his neck. The analyzer matched it to Miles Bowman.

"I don't get it," said Shad.

"What's that?" I asked as I logged and filed the data.

"I've been wringing this nag's sponge with my neural image reader, and Champion isn't just subhuman, boss; he's subhorse."

I faced Shad and returned the analyzer to my pocket. "How so?"

"Watch out!" screamed Shad looking behind me at something way up there.

I turned and Champion had reared back on his hind legs, his front hooves pawing at the air, his wild-eyed gaze fixed directly on me. "Bloody hell!" I cried as the hooves came down hard. Thanks to Shad's timely warning, I avoided the brunt of the onslaught, only catching a glancing blow above my left temple. Nevertheless it was sufficient to knock me off my feet. I collapsed in the straw in one of the corners, my ears deafened by the most horrible screaming. When I could focus my eyes again, I was momentarily powerless to do anything but watch as Shad distracted the murderous brute from killing me by flapping his wings and running figure eights between and around the horse's legs, all the time screaming "Aa-flak, aa-flak, aa-flak, aa-flak!"

Torn between trying to get away from the duck and trying to kill it, Champion

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lost track of me long enough for me to pull myself up, stumble to the stall's gate, and get on the other side. As I slammed shut the gate, automatically latching it, Shad came flying over the top, landing in the center of my chest with sufficient force to knock me on my backside.

As I sat up I saw Shad flat on his back, wings straight out against the floor, his webbed feet sticking straight up in the air. It looked to me as though he had lost a considerable quantity of feathers from his left wing and tail. "Well," he said, looking between his legs at his missing tail feathers, "I'll be plucked."

"Close to what I was just thinking, as well, Shad."

"I bet." Using his wings, he rolled himself over on his left side, at last flopping on his breast. Another couple of flaps and he was wobbling on his feet, which is more than I could say for myself. I noticed several drops of my own blood decorating the left lapel of my suit. "Oh, dear."

"Not that bad," said Shad, looking at my head. "Cut. Bruising. You might need a butterfly or two. Not as bad as it looks."

"You'll have to come home with me for dinner, Shad."

He cocked his head at me in modest wonderment. "Great. When?"

"Tonight."

The duck stared at me for a moment. "Kind of short notice."

"Can't be helped." I debated with myself for a moment, then confessed. "My last year in Metro I was wounded during an arrest. Shot. In and out my left bicep. I had it treated, went home, and told Val it was nothing."

"Then she found out the truth."

"Quite. Ever since, if I have any kind of injury, I need to provide a witness if Val is to believe that it's nothing serious. There's a man who comes in to cook—the mech I mentioned, actually. His name is Walter. I'm sure he can make something you can eat."

"I eat everything but waterfowl and spinach," Shad answered. He seemed to frown for a moment. "I can tell Val your injury isn't serious, but how you got that injury is real serious. It's what I was trying to say when we were so rudely interrupted. About the neural scan I was doing on Champion?"

"Yes?"

"That nag has been fried, partner. I'm surprised he has enough of a nervous system left to feed himself."

"He seemed bloody spry to me."

Shad cocked his head to one side, glanced at the door to Champion's stall, and looked back at me. "While we were in there, someone hit Champ with an image implant. I was reading it when the horse freaked: Truck full of toilets runs over horse? Desert equine destruction—"

"*Charge of the Light Brigade*," I completed. "How could someone do an image implant in a horse stall unobserved? For all that matters, how could they do it in a forest? As I recall, that equipment is heavy, awkward, and that doesn't even include the power requirements."

"However impossible, that horse was panicked into trying to kill to defend itself."

"Someone is going to a lot of trouble to pin Miles Bowman's death on a horse."

"And whoever it is doesn't seem too particular about who gets killed to do it."

We both thought upon that for a moment, then I faced him. "Shad, when we were in there and you were busily and quite bravely saving my current life, there was something you kept screaming."

"Oh, that." He squatted and sat like a duck, his gaze wearily on the beautifully tan and rust tiled floor. "From my old commercials. 'Aa-flak!'"

"Yes."

"Spelled different than it sounds. Pressure is what does it. Handy during cattle calls when you're really stressed. I never

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forgot a line. See, when the weight's on, all I can think to say are old lines from scripts I've memorized." He faced me and said, "'Here's looking at you, kid,'" with the voice of classic actor Humphrey Bogart.

We heard a siren and in moments we saw a Houndtor Down ambulance approaching us through the corridor. "I wonder," Shad asked with just a touch of perpetually rejuvenated comedian Robin Williams in his voice, "is that for us or the horse?"

After informing D. Supt. Matheson of our progress, leaving him even more convinced that Lady Iva was innocent, I brought Shad home for show and tell. Even after his harrowingly honest account of our brief misadventure with the deceased's horse, Val seemed less concerned about my condition or who might have caused it than she was about how famously I was getting on with my new partner.

Walter had prepared an appetizing eggplant Parmesan and judging from the quantity Shad put down, it was duck-compatible. Despite being a mech and frequently in a state of melancholy, that evening Walter couldn't resist laughing at his own duck jokes (There was a veterinarian he knew who was a duck, but the guy was a quack). Despite Shad's exception to fowl references upon our first acquaintance, he gave Walter as good as he got with a repertory of his own mech jokes that even had Val laughing (How many screws in *does* it take to light a robot's bulb?).

Once dinner was finished, Walter cleared the table and began cleaning the dishes. Val, Shad, and I moved to the lounge. Shad stood on an end table and slurped at his mint tea, Val curled up on the folded duvet on the settee, and I sat next to her and sipped at my Assam. The telly was on to BBC 228, which was airing the original *Casablanca* with Humphrey Bogart, the lovely Ingrid Bergman, and the forgivably corrupt police official, Claude Rains. I had imagined it would be a treat for both Shad and myself, but I wasn't able to concentrate. It had been a while since anyone had tried to kill me, and all those old feelings were back again: fear, paranoia, anger, and a sense of relief I couldn't trust. Shad wasn't paying attention either.

"Jaggers?" he said. "All right if I call you Jaggers? The boss-inspector thing seems a little bulky."

"No objection. How is your south end?"

"Sore. How's your head?"

"It feels like a horse kicked it. Something you wanted to ask?"

"Yeah. After I did that scan on Champion, remember I said the nag was fried?"

"Something about being surprised he could still feed himself."

"Yeah." The duck jumped down to the floor and began pacing. "On the Benton-Lutz AB Scale, average horse intelligence is twenty-seven point something. Back there in his stall Champion came in at a four, which is only a little better than a banana slug."

"That's not fried, Shad. That's cremated."

Shad froze, then slowly turned and looked at me. "Insects. Fly on a wall," he said at last. "The expression, you know? I wish I was a fly on that wall, meaning I wish I could've seen and heard what was going on in a particular place unobserved."

"Yes?"

"Remember years ago the surveillance industry offered a prize to whoever could figure out how to successfully human imprint a mech or bio vehicle under one and a half millimeters in size?"

"Yes. They couldn't compress a complete human imprint below something much larger—well, the micro you used to map the burrows today. That's as small as it can be done without a severe loss of information. Didn't the industry began experimenting using remote aux-

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iliary processors to hold the mass of the imprint and through it direct the bio?"

"Yeah. *Bio Week* and *AI Times* both had pieces. It was a big deal for about ten minutes." Shad's pacing became a bit more frenzied. "To a man in a bug POV suit, it was supposed to seem as though he's crawling or buzzing around with everything on board, but the imprint really wouldn't be in the bug."

I leaned forward, my headache temporarily forgotten. "But they never got it working."

"No. Something to do with neural equivalency failure and remote transmission fidelity. Too much of the first and too little of the second." He stopped pacing and faced me. "After it was dropped, Fantronics used the research they'd done to come up with a prototype master/slave unit that was put into trials to see if it would be effective and safe for implanting images for use in mental health treatment."

"I don't remember that."

"You wouldn't unless you'd been in one of the trials." He held up a wing to preempt my next question. "They had gotten a portable imprinter down to the size of a Kaiser roll and were lining up amdroids under psychiatric care for clinical trials. After my wife dumped me, I was seeing someone because of a little depression I was going through. Anyway, before the trials even got started, the wheels came off the program and it was dropped. Then Fantronics unleashed an army of media molders to assure everyone in the world that there never had been any program, and if there had been a program, Fantronics didn't have anything to do with it, and if they did have something to do with it, no serious lasting effects had been suffered."

"*Big* law suits?"

Shad whistled and held his wingtips far apart. "Law firms were beating the law schools for recruits. See, what the Fantronics lab came up with was a brand new compact way to take perfectly sane individuals and turn them stark barking bonkers." He lowered his wings. "If they could do that with a human, why not with a horse?"

"Rather sophisticated, but that might be our murder weapon." I drummed my fingertips on the arm of my chair. "For what possible reason? The success of Houndtor Down Hunts has been an enormous free advert for the corporation's fantasy amdroid lines. Killing Miles Bowman with a Fantronics amdroid horse—"

"—could destroy the corporation," Shad completed. "Disgruntled employee? Someone connected with the cancelled project?"

"Fund my project or I'll take everyone in Fantronics down with me."

"It could get us a trip to London, Jaggs. I love the parks there."

"It's a little early for vacationing." I pointed at my partner. "Get on the net and see how Fantronics's stock is doing."

After a few moments of tail twitching, Shad looked at me. "No real changes: between three-ninety and four hundred a share, the same as it's been since the general market increase this past January. No layoffs at Fantronics. They're hiring." He paused for a moment. "Want to supervise a recreational program for used bios that've been engram-scrubbed? Some housebreaking training involved, no experience necessary, bring your own mop."

"I have another commitment."

Shad whistled. "Want to know the starting salary?"

"It would only discourage me." I took a sip of tea and put my cup down on the coffee table. On the telly Claude Rains was shocked, shocked to find out there's gambling going on in Casablanca. I picked up the remote and paused the flick. "We're not getting anywhere with motive. Let's focus on means."

"Okay." With a flap and a hop, Shad was back on the end table. He took a slurp of his tea, sat down, and said, "We

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know the ability exists to remotely implant images that can trigger off a homicidal nightmare, and it's pretty clear something like that was done to Champion when the horse killed Bowman and when he tried to kill us." Shad looked at me. "And?"

"If we can find out where the image implant device was located when it triggered Champion in his stall, we might find a trail that we could follow to our killer. I haven't looked at your burrow map. Any of those burrows come near the stables?"

"No burrows. Just a conduit carrying vid feeds to the studio wing. No access into the pipe. The actual fox burrows are pretty much limited to Old Bones Village, extending south and southwest from the ruins coming up at various places on Houndtor Down, Holwell Lawn, and Hedge Down on the other side of the road to Manaton. They have remote camera hookups throughout the whole area so they can continually vary the route of the chase. Only the burrows in the village are dirt and rock. The long ones that come up in the chase areas are forty-centimeter-diameter plastic pipe. Archie's hair is in the Old Bones Village burrows and throughout the pipes that come up in the chase areas.

"If Houndtor Down Hunts put in all that pipe, the plans should be on file with the Dartmoor National Park Authority. There has to be a way to get at Champion's stall. When you have a minute, Shad, access the plans on file with the authority and see how they compare with your map."

"Will do. Something to think about though, Jaggs." Shad glanced at Val, noted she was sleeping, and said in a lower volume, "That horse is still a dangerous weapon. How's your head? Personally, I'm not eager to donate any more feathers."

"Point taken." I looked at Val. Often when she looked asleep she was only relaxing. Then a thought came to mind that chased away all caution. "What about us, Shad?"

"Us?"

"We both have bio receivers. If our killer has the means to make horse androids crazy, what about us?"

He looked down and slowly shook his head. "The prototype made humans crazy. That's why the program was dumped. I think we have to assume whoever made Champion crazy can do the same for us, and will do it if we get in their way."

"Even killers have to sleep sometime," interrupted Val as she yawned and stretched her front legs.

"I apologize for keeping you up, dear," I said. "We'll be done in a minute."

The duck jumped from the end table to the floor and waddled over to Val's end of the settee. "I believe Val was suggesting that right now might be an opportune time to sneak into the stable wing to take a peek."

"Smart bird," she responded as she rose, arched her back in a global stretch, turned around twice, and settled back into the same exact position.

She was probably right, too. Unless the killer had accomplices, there was no way to stand guard on everything all of the time. I stood, petted Val's head and ran my hand down her back. "Thank you, dear. Don't wait up."

"I never do," she said with her eyes closed. "Harry?"

"Yes, dear?"

She looked at me. "It's good to see you after a killer again." She glanced at Shad then back at me. "Both of you, take care."

On the way from Exeter, Shad accessed the plans filed with the park authority, and the underground piping Quartermain used for long-distance burrows matched exactly the map Shad had generated, including a strange little cave near Old Bones Village Shad had mentioned. The burrow Quartermain had used to exit from Bones' chamber led to

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the cave, but, although there were cracks in the upper part of the chamber, allowing a little light and more than a few bats to enter, Shad hadn't found any exit large enough for a fox. Judging by the number of bat wings he had found without bats between them, Shad concluded the cave was one of the places where the Quartermains dined.

There was drainage piping from the stables, but it was a completely separate enclosed system with all wastes purified and recycled. No connection to the fox runs. While he was at it, Shad ran a search on anyone who ever had any connection with Fantronics's experimental insect imprint or mental health programs. The scientist who had been in charge of both programs, Beatrice Widdows, PhD, had moved to Florida three years before to join the faculty of the state university there as professor of applied biotronics. It was reputedly the only college course in the world taught by a manatee. Among the names of Dr. Widdows's assistants that Shad had listed, the name of one caught my attention. "Why does the name Shirley Wurple seem familiar?"

"Dr. Wurple is the current bio android assignment supervisor at Fantronics. Remember, she ducked my call?"

"Is there any connection between her and Houndtor Down Hunts you can find?"

"Working," Shad announced as his tail twitched. As the cruiser came down from the Bovey Tracy Roundabout, the rain had stopped, but it was still overcast, making the night deadly dark, which was perfect for our purposes. Just as we came over the village of Leighon, Shad announced, "Back at the beginning of Houndtor Down Hunts, when Archie Quartermain imprinted onto his first fox bio, Dr. Wurple assisted Dr. Widdows with the imprint and supervised the transfer of Archie's human meat suit to its new owner. As far as my software knows, that's the only connection. Where do you want me to put down?"

"Put us into a hover just east of the lodge grove below treetop level and run up both micros. If we find another way from Champion's stall out of the stables, we're going to follow it wherever it goes."

Copied into our micros, we entered the stables through an air vent leaving open the hole we had made through the screen and air filter. Keeping above the cameras and motion detectors, we came to the horse stable wing and once there, aligned ourselves behind a vertical electrical conduit and descended until we could enter an open transom. Keeping beams, boxes, or bales of hay between us and the security sensors, we made our way to Champion's stall and slipped in undetected. The horse was lying down in the straw on its right side.

"I thought horses slept standing up," said Shad on our secure net.

I hovered my micro just above the horse's head and extended my holo. "They may very well sleep standing up, Shad, but this one is as dead as Dillinger." I did a quick neural activity scan and came up empty. "This bio has been dead long enough to zero out all recoverable neurological activity and data." I initiated a full scan and Shad opened a channel to it and watched. We both noted the results at the same time: Champion's red blood cells were almost devoid of oxygen.

"Chemical asphyxia?" said Shad.

"Let's see." I looked up horse anatomy, located a big artery, and shot an independent microanalyzer into the dead animal's blood stream. The rice-grain-sized laboratory reported its results within seconds: "Blood cyanide level: two-point-three milligrams per liter. Get a liver temp."

Shad moved his micro around to the horse's flank and fired a sensor into the dead animal's liver. "Champ's been dead about two hours."

"Perhaps our killer was neating up." I

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looked back at the dead horse. "The poison still had to be administered. Do your wireless magic and see if you can access the stable security vids. Any and everything of Champion, his stall, and anyone going to or coming from the stall the past three or four hours. I'll check the horse's food and water and see if the poison was administered that way."

"I'm on it, Jaggs."

While Shad was busy accessing the security vids, I tested Champion's water and feed station for cyanide. Neither had even trace amounts. The feed was automatically mixed, apportioned, and transported to the stalls on overhead belts, and down through vertical chutes into the feeding stations.

"Shad, while you're checking the surveillance vids, be a good fellow and run the schematics for the automated feeding and watering systems. See if there's any way for something or someone to get through them into the stalls."

"Got it."

On the other sides of the walls—both sides, the back, and back corners—were other stalls, all occupied. I checked the adjoining stalls and examined the walls. They were covered with white imitation wood planking made from a durable combination of poly and gypsum cement. Very well done. Until I actually put the holo to them, I thought them to be of genuine oak. The stall walls were solid down to the imitation concrete plastic foundation. The foundation was solid and one uninterrupted piece with the textured floor. I poked through the straw on the stall floor, as well as beneath lumps of horse poo, finding no opening large enough to allow even a micro to enter, much less something as large as a Kaiser roll.

"I've run through the vids of all three cameras that have views of this section of the horse stables, Jaggs. Nothing."

"The feed and watering systems?" I prompted.

"The water goes through a series of filters and screens. The feed is run through larger mesh screens, but goes through foreign matter detectors designed to find and remove all ferrous and nonferrous metals, plastics, rocks, insects, rodents, contaminants—anything that isn't the intended feed. Find anything with the foundation or floor?"

"What I found was that this building is tight and made of practically indestructible materials. The only place I haven't examined is beneath the horse."

"We could put our power supplies in parallel and give Champ a zap," Shad offered. "Maybe we could frog-twitch him off that spot."

I aimed my lens at my partner. "Before resorting to measures that have equal chances of either crushing our micros or setting this straw on fire, Baron Frankenduck, let's do density and matrix continuity scans on the floor and foundation that we can reach."

"Think someone pulled a plastic plug and put it back, Igor?" he said, I believe, with the voice of Colin Clive.

"Let's see. And that's Detective Inspector Igor to you."

Density and matrix continuity scans, originally adopted by forensics for restoring purposefully obliterated serial numbers from weapons, autos, and stolen goods, were, because of that, deadly slow if the area to be scanned was larger than a few square centimeters. The stall was approximately three meters wide and four deep. Fortunately, we both began scanning at the back of the stall, I on the right and Shad on the left. We hadn't been at it longer than twenty minutes when Shad said, "Got it."

I glided over to his side of the stall, tuned in his scan, and saw in his corner of the stall an arc, the complete circle of which would be twenty-five centimeters in diameter and would include part of the floor and a bit of the back. I began scanning the back, and in minutes we had marked bits of arc the complete circle of which would, if the plug were removed, make a rather high-tech foxhole.

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"Are we back to Archie Quartermain?" asked Shad. "What motive?"

"Perhaps he's a better actor than you thought. He originally got into that fox suit for money."

"I don't buy it. Back when we were in New York, Archie liked money the same way I liked money. We both preferred eating to starving and sleeping with a roof over our heads to shivering beneath all the news that's fit to print out on a park bench. In the end, that's why I became a cop and Archie became a fox, but money wasn't what was driving us. Acting, getting a great role, hearing that laughter, that applause, getting a thousand men and women to play with you at the same time, leading them along into your game, and springing the surprise on them, collecting all those oohs and aahs. Applause. That's what drove us—that's what drove Archie. Judging by what he told you when I was out mapping the burrows, that's what's still driving him: the game, although I admit the appeal parameters seemed to have changed."

"So, what else can fit through a fox hole?"

"Fox terriers," offered Shad. "Various mechs, squirrels, rats, all kinds of birds, weasels, badgers, monkeys—"

"You said your package included thermal imaging," I interrupted. "How sensitive is your system?"

"I can track another bird through the air by the long heat trail it leaves and can determine which shotgun a duck hunter used five hours after it was fired by the heat differential between it and the hunter's unfired weapons, and that with a load of birdshot in my butt."

"Shad, we have to get back up to the cruiser. When we get there, move into your feathers and do a scan around the lodge and stables for the underground route that was used to get in here. Whatever was used, it had to generate some heat to get through this foundation. My instruments, crude as they are, can detect a temperature differential between the inside of the arc we've been scanning and the surrounding material."

"What are you going to do?"

"Perhaps I'll find a shovel to wield."

Shad's micro hovered for a moment, then he said, "You're going to make me copy into the big mech and do the digging, aren't you?"

"Unless your scan can find us another way in."

While I downloaded my data into the cruiser's computer, Shad did one quick flap around the lodge and stables. Long before I managed to copy back into my meat suit, he was back with a report. "I found the underground tunnel coming out from beneath the northwest corner of the lodge. That was the end cut last. From there it runs around three meters deep northwest, then arcs until it heads southwest, arcs again until it's headed southeast, and then the thermal signature is so faint my equipment can't pick it up. The largest part of what I could follow was cut through mostly solid granite."

My sync was complete and I sat up and pointed at the cruiser's data screen. "Show me."

It was as he said. In addition, the trace was very regular, not a perceptible difference in diameter between any two parts of the machine-cut tube. Every detectable portion of the tunnel was three to four meters deep, most of it running through granite. If we were going to break into it, we'd need equipment, explosives, daylight, a crew, and to throw away any kind of edge surprise might lend us. I glanced over to the driver's seat, and Shad's tail was twitching. "What are you doing?"

"Searching for small-diameter tunneling equipment. I've found three designed for putting in water and sewer lines, as well as running conduit through masonry, that can do the tunnel job we detected. The Euclid 750 Pipe Snake is what was used to put in all of the long-run tunnels Houndtor Down

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Hunts uses to run camera feeds along the different fox runs. I see it's pretty obsolete, too, as far as knowledgeable plumbing and sewerage dons are concerned."

The image came up. The Euclid model resembled a horrible huge snake, the mouth on its fearsome head tipped with ghastly-looking circular grinding teeth. Just behind the teeth were high-pressure water jets and intake holes to float the stone dust and remove the slurry. Just behind the takeaway scoops was a gasket, and behind that were holes designed to inject and coat the interior of the tunnel behind the head with a smooth layer of chemical and weather-resistant plastic. The rattle on the tail of this snake was a huge piece of nuke-powered equipment that would be incredibly obvious wherever it was used. Shad pointed out that the Pipe Snake could have easily made the hole into Champion's stall, but all it could do after that is coat the inside of the opening with plastic. It couldn't have refilled the hole.

"The other two models are the Pipe Dream, manufactured in Macao by Red Star Industrial, and the Magic Mole, manufactured in Burbank by an outfit called Whack-A-Hole. Both pieces of equipment use the same technology, matter transcompression—"

"They eat dirt and rocks and squirt out pipe."

"Yes. Self-contained, nuke powered. A feature of the Magic Mole, however, is its ability to fill the pipe it's made with anything the contractor wishes, whether it's an inline computer-controlled valve, a line switch—"

"Or what it removed," I completed. "Does Whack-A-Hole have a twenty-four-hour office in London?"

"Yes."

"See if Marcus Licinius Crassus can get the manufacturer to give up a customer list. Meanwhile, take the cruiser over to where Bowman's body was found. If our killer used a Magic Mole to get a portable image implanter into Champion's stall, I'm pretty certain the same was done where Bowman was killed. Perhaps we can get in at that end. The forest floor there, at least, isn't made of plastic or granite."

It was well past three in the morning by the time we located the tunnel entrance. It was beneath the remaining branches of the dead tree next to the pine that had Champion's hair on it. No attempt had been made to fill the hole. It looked, in fact, as though a fox or some large burrowing animal had dug it. Shad had Whack-A-Hole's British customer list, and it was daunting. Every municipality, hamlet, and large institution in the country had one or more of the tools, as well as plumbers, drain layers, and building contractors of all types. For the mundane tasks of laying pipe or running conduit, it seemed, there was nothing like a Magic Mole. To take all the variously formatted employee databases of all of the institutions and companies and run each person's antecedents against our total name database was beyond our capacity. Shad logged into the Heavitree ABCD Center and gave the task to the mainframe. Meanwhile, we got small, copied into our micros, and entered Whack-A-Hole's underworld.

Once the excitement of being confronted by a belligerent salamander and several alarming spiders was past, monotonous would be too generous a description of how it felt to be in a flying lipstick traveling down an apparently endless but definitely featureless length of dark pipe. After a few minutes of travel there was a very gentle arc toward the northeast, and we traveled along that, gradually descending all the while. After more than an hour of this, another gentle arc had us heading due east, but still descending. "Here's something interesting," said my partner at last.

"Let me have it, Shad. I'm stimulation-starved to the point where I could ea-

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gerly listen to knock-knock jokes."

"You know how fast a twenty-five centimeter diameter Magic Mole can travel through an unobstructed pipe of its own manufacture?"

"Can't say that I do."

"It can top sixty kilometers per hour under its own power. With compressed air behind it, the mole can top a hundred and seventy."

"Fascinating."

"I only bring it up, Jaggs, because I note we are both flying along at our top speed of four kilometers per hour. Sort of made me wonder what the plan is, should we find a Magic Mole coming at us from the other direction."

I thought on it. "In such case, we get annihilated. Now that you bring it up, it would probably behoove us to maintain a continuous data sync with the cruiser. That way, should we get swatted, we'll remember it. What's our signal like to the cruiser pickup?"

Shad ran a quick signal strength and fidelity test. "Weak. I'm bringing the cruiser over our present position." After a minute or two, Shad ran the test again. "Perfect. As long as the cruiser follows along above us, it should be fine."

"Very well. Keep an eye on the autodrive monitor, though. Wrapping the cruiser around a tree or dashing it to pieces on a building or rock cliff would be all Supt. Matheson needs to sack both of us."

"Something from Exeter coming in," he announced. "Fantronics's maintenance division currently keeps three Magic Mole systems in its inventory. Two of the systems were replaced three months ago. Apparently the replaced systems were destroyed along with a lot of other equipment when the division's warehouse in Reading was consumed in a chemical fire. Kind of a drastic way to cover up an equipment theft," he observed.

"But effective."

That was all the excitement we had until we came to a point just west of Old Bones Village Ruin. Twenty meters north of the National Park Information Center was a junction. To our left a tunnel led due north. That was likely the other end of the tube that led to Champion's stall. Straight ahead, however, was the real question mark. Without discussion, Shad and I had both flown in that direction. Another few meters and the tube took a ninety-degree turn south.

"Oops!" said Shad.

"What is it?"

"Nothing."

"You said 'Oops,' Shad. Oops is never good."

"We—I almost ran the cruiser into that little information center in the ruins. I put it in hover park." He aimed his sensors at me. "That's where the tunnel leads, Jaggs: the basement of that building."

"Find out who is employed there."

While Shad accessed the park authority records, we moved ahead until suddenly there was a light at the end of the tunnel. Several lights, actually. I zoomed in on them and they looked like instrument lights on some sort of control panel.

"Hold up, pard," said Shad, causing both of us to come to a halt.

"Who did you find?"

"No one—I mean, there's no record of anyone ever being employed there. According to the Park Authority, there is no information center there. There's no record of anyone even thinking about it. It's a front."

"Shad, give me the cruiser controls." In a moment, I was looking through the cruiser's forward camera. It was still dark. The infrared illumination revealed the back side of the little building. A late-model Honda electric was parked there on the uncut grass. I maneuvered the cruiser around until I could see the front of the building. As evidenced by the weeds and grass growing in it, the crushed gravel path to the front door had seen little traffic. There was a sign

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on the door saying that the center was closed for repairs and thank you for all your patience. I left the cruiser hovering there and turned to Shad. "Let's go."

We moved toward the end of the tunnel, and long before we reached the end we could tell the space beneath the small building was much larger than the structure above, the curiously scalloped walls apparently carved from the granite bedrock courtesy of a Magic Mole. There was the sound of a small internal combustion engine running. The panel lights we had seen from inside the tunnel were mounted in the face of a large orange-colored console. Mounted above the lights was an identification plate, which cleverly named the machine upon which it was mounted a genuine Whack-A-Hole Magic Mole Control. To the right of the console on the wet granite floor were what looked like pipes of different diameters. Shad moved over to them to see what they were. Beyond the pipes and extending as far as I could see in the carved-out space were what looked to be piles of purple glass hockey pucks—millions of them.

"These pipe thingies are different-sized Magic Mole bits in their containers," said Shad.

"See if you can tell what those piles of purple things are."

"Puckets," he answered immediately.

"Sorry?"

Shad aimed his lens at me. "I ran across it when I put in the search for boring equipment and came across Whack-A-Hole. Transcompression equipment manufacturers call them puckets. When the Mole goes through certain dense materials, like granite for instance, there's stuff left over after the matter transcompression forms the tube lining. The Mole compresses the excess material to about a sixth of its volume and excretes it in this form: puckets." Shad aimed his lens to his right. "Hello?"

I turned in the direction my partner was facing. Behind the Mole control unit was a refrigerator, a table with a hotplate, and a shelf with a few tins and boxes on it: biscuits, crisps, jam and such. To the right of this rudimentary kitchen, standing next to a stairway, was a forty-year-old vertical EMU capsule, its casing scratched and dented, its bottom sitting in at least five centimeters of water. "Where's all this water coming from?"

I slipped a bit to my left and saw the companion capsule standing next to the first in a send-receive configuration and a massive old engram management unit console beyond it. I hadn't seen equipment that old since I copied into my first bio. The EMU console was located next to an equally vintage stasis bed. In repose upon the bed was a middle-aged woman dressed in Wranglers and a Harris tweed jacket over an olive turtleneck. Her hair was graying, unusually short, and she wore heavy black-framed eyeglasses. Her skin color was bright red. "Shad, run the air quality."

After thirty seconds, Shad said, "I'm glad we're in the mechs, Jaggs. The carbon monoxide level in here is lethal. If she's not dead, she's not an oxy breather."

"Get a DNA and liver temp."

While Shad was sticking a needle into the corpse, I flew past the stasis maintenance console following the sound of what I suspected was a generator. Indeed it was, and a petrol burner at that, the fuel bladder tucked into the northeast corner of the chamber. Air was piped into its carburetor from outside and the exhaust fed into a stack that went up through the floor above. The seal between the purple glass exhaust pipe and stack was leaking badly, the glass apparently cracked. Just behind the generator, the scalloped chamber wall was wet and dripping. It was rainwater seeping through the dirt between the edge of the building and the bedrock.

I reversed course and as I passed the stasis bed, Shad was running the DNA ID on the body. Past the EMU capsules I

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turned left and left again to go up the long staircase. The door to the upstairs was open slightly and I moved in, the overcast sky visible through one of the windows just beginning to grow light. There was enough furniture and decoration in the room to convince someone looking through a window that this was indeed an official information center. There was, however, only the one room, a closet with nothing in it, and the stairwell leading to the mysterious cavern below.

I did a quick analysis of the upstairs air and the carbon monoxide level above ground was even more concentrated than below. The exhaust stack from the generator came up through the floor at the back of the building, apparently with the assistance of a Magic Mole, which had made the glass stack pipe, as well. The piping ran across the open ceiling and up into the casing of the pseudo brick chimney. Prefab the building might have been, but it was fairly tight, without a crack or hole large enough for me to get to the outside. I was about to call an end to my meat suit's stasis and have myself land the cruiser and open the door with a pry bar, but I hate doing that. When the mech and the meat suit both are running at the same time and independently altering our engram content, there are always sync problems with useful items frequently deleted in the resolution. It was unnecessary, though. I opened the mail slot in the door and exited through it. Once outside I moved up to the roof and over to the chimney. One glance down the chimney showed what was blocking the generator exhaust port: dead birds.

As I came back through the mail slot and down the stairs, Shad was returning from the direction of the pucket dump. We both altered direction and stopped at the stasis bed. "Did you ID the body?" I asked Shad.

"DI Jaggers, I'd like you to meet the late Dr. Shirley Wurple. She's been dead a little over three hours. Find out where the water's coming in?"

"In the back. There's no foundation. The rain caused the building to settle slightly, which cracked the exhaust seal and probably toppled a couple of dead birds in the chimney over the exhaust port, blocking it."

"Something doesn't mesh, Jaggs. She's a wheel at Fantronics, right? She has to have access to better equipment than these old junkers."

"Probably left over from her research days with Dr. Widdows, Shad. She wanted her plans under the radar. Junkers are junked, you see, not registered."

"So, why? We're back to motive. Why'd she try to kill us and, presumably, Miles Bowman?"

I thought on it until, at last, a mouse brought me the answer. "When you were married, Shad, before your flying days, did your wife ever bring you a sweetie when you were feeling low, some sort of little treat to bring you out of your doldrums?"

"Sure—" He aimed his light at me. "The mouse! That doesn't happen with real critters and their mates."

"She tried to kill us, Shad, because she didn't want us to discover that she killed Bowman. She killed Bowman for the very noblest of reasons: to protect her family. She's Archie Quartermain's mate and is about to become a mother. I think if you check inside those EMU capsules you'll find fox hair that won't match up with Quartermain's. Have you seen that image implanter?"

"I haven't found it, and I looked."

"Unfortunate."

"Jaggs, don't you think Archie's in this with her?"

"No. I believe your old roommate thinks his mate is a genuine vixen. Why should he think anything else? He's not a proper fox himself. Where's his den?"

"When I was mapping the dirt tunnels, I found a couple of wide spots, but nothing like a place to sleep or make little foxes. No little animal bones—"

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"Can you get us back to Old Bones, where Quartermain first talked to us?"

"Sure, but it'll take hours to go back the way we came."

"Let's take a shortcut. We can get out through the mail slot."

I led the way and we hurried. There was no telling what Shirley Wurple might do with that image implanter once she awakened and found out she was dead.

Once we left the mail slot, it was a mere thirty meters south to reach the entrance to the burrow. After reaching his rather lean receptionist, I led the way over Old Bones's ribcage to the back of the chamber and into the hole between the two rock slabs. According to Shad's map, the hole turned abruptly down, then zigzagged generally southwest until it entered an inclined shaft carved by groundwater. The shaft led to a small grotto illuminated by two very dim cracks of natural light from the surface. There was not even enough room for a man to stand upright, but the tiny cave averaged between one and two meters wide and well over forty meters in length where it began sloping down, the overflow pouring into a rubble-filled channel that presumably found its way to Becka Brook.

"When the vixen brought Quartermain his mouse, this is where she came from. This is to where Quartermain followed her after leaving me." I turned and aimed my lens at Shad's micro. "Something I don't understand. With the research Quartermain did on foxes and the hunt, your old roommate had to know about that mouse—that it didn't fit. Is it possible that Archie Quartermain deluded himself into thinking Shirley Wurple is a real vixen?"

"You should've seen me stalking that hooded merganser all over Maine. It's a good thing she was a real bird or she would've taken out papers on me. When you're lonely and desperate, you can talk yourself into believing anything. Archie lives in a hole in the ground. By the time he could afford to buy himself a designer meat suit he was already a fox in his head. Trouble is, when we copy into one of these ams, we bring that human need for companionship along with us. After a lonely couple of years by himself, running before the hounds his only meaning in life, along comes this warm, cute, sexy little vixen who wants to rub, cuddle, bring him mice, and make little foxes. You bet he could delude himself—Hold it."

After Shad's warning, we both fell silent and streaked for cover. We were behind a small ledge, our lights off, our sensors on. A warm mass was entering the chamber from above. "I heard that," said a voice. It was Quartermain. Shad and I moved our mechs out from behind the ledge. The fox was standing beside the pool of water. "What are you two doing here?" he demanded.

"Where's your mate, Arch?" asked Shad.

"My mate?"

"The vixen who's fixin' to make you a pappy."

He walked a few steps in one direction, then turned and walked back, leveling his gaze on Shad's micro. "What do you want with her? She's a fox—a real fox."

"She's nothing of the sort," I said. "She's a Fantronics bio imprinted with the engrams of a woman named Shirley Wurple."

Quartermain was so still he could have been a taxidermist's showpiece. "*Doctor* Shirley Wurple?" he said to my micro.

"Yes."

"The person who . . . *Bloody hell.*" He sat next to the water and stared deep into the pool. "She killed Miles, didn't she?"

"Yes," I answered as Shad crossed the pool to investigate something. "I don't know if this helps, Quartermain, but I think she believed she was doing it for her family: you and the coming cubs."

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"How did she do it?"

"During the run, after you passed that spot in Quik Grove lane, she cut your scent trail with probably some sort of chemical, then laid a drag trail into the thick woods, probably with one of your former body parts from a previous hunt."

"She has an old tail of mine. A bit morbid, but I thought it was kind of touching."

"When Miles reached that particular spot in the grove, she hit the horse with an image implant that drove the animal insane. Champion saw Miles Bowman as a threat—"

"—and then Champion trampled to death the man who loved him more than anyone else in the world," completed Quartermain. "This is insane. Back in the Fantronics lab, that woman—I thought she was joking. She made like she was flirting with me when she was getting me ready to print into my fox suit—making jokes about buying my human self and bringing it home with her for fun and games—She must've been sixty! You don't suppose she actually bought me."

"No," Shad said from the other side of the pool. "The old you is in Hollywood right now under the name of Trent Scanlon playing the feature role of Saddam Hussein in the black comedy *Uday and Qusay are Ed-day*. Principal photography began last February."

"Hollywood," the fox repeated. Again he was motionless, no doubt having one of those life-assessing moments. Lifting his head, at last, he faced me. "How can you be so certain she did it?"

"She tried to kill us, too." I explained how the vixen had tunneled into Champion's stall and how we discovered her expired human meat suit below the phony National Park Information Center. He shook his head at last, got up on all fours, turned toward the back of the chamber, jumped up on a ledge, and seemingly vanished into the rock. We heard his voice say, "This way."

I moved up to where Quartermain seemed to have vanished and saw a shelf of stone. Just beneath it was an opening that was impossible to see unless one was right up on it. "This way, Shad."

"I found something," he said.

I moved back down and crossed the water to where Shad's light was illuminating something the size of a dinner roll that looked sealed in waterproof plastic. "Is that the missing portable image imprinter?"

"She tried to hide it in the water. The vixen carried it down here holding the plastic bag in her mouth. Tiny, sharp, little teeth. Water got in the bag. We'll be able to match Wurple's bio to the bite mark impressions."

"We'll need the tracked mech to bring it out, Shad. Before we do that, call it in to Police Constable Lounds for the arrest. That ought to raise his esteem in the park constabulary."

"I'd love to see his boss's face when he finds out his case fell apart."

"Let's get to Quartermain's den. Your old roommate is about to give up his mate."

"Why did you kill Miles?" we heard Quartermain demand as Shad and I came out of the tunnel into a chamber where the only illumination was provided by our lights.

"I didn't mean to at first," answered the vixen's tearful voice. She looked at us, her eyes wide. Looking at Quartermain she said, "Really I didn't. I'd hoped to frighten him out of the—Oh, I can't look at you and tell you this!"

"It doesn't matter. I'm sending you over," said Quartermain. He seemed to laugh to himself—at himself—then he glanced at Shad's micro and hung his head. "Yeah. I'm sending you over," he repeated as he slunk out of the chamber.

She turned from watching Quartermain's departing tail, and laughed nervously. "Oh—he frightened me for a moment. He was joking. That's it. After

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all, I'm carrying his babies. He was joking, wasn't he?"

"Don't be silly," said Shad in that special Bogart voice of his. "You're taking the fall. You killed Miles and you're going over for it."

"How can you . . . how can he do this to me?" She broke down and began a really irritating series of whines.

"Listen," said Shad after awhile. "This won't do any good. You'll never understand me, but I'll try once and then give it up. When a fox's partner's killed, he's supposed to do something about it. It doesn't make any difference what the fox thought of him, he was your partner and you're supposed to do something about it. And it happens they're in the fox hunting business. Well, when one of your fox hunters gets killed by a fox, it's bad business to let the fox get away with it. Bad all around. Bad for every fox hunting operation everywhere."

Shirley Wurple didn't know her next line from *The Maltese Falcon*, which left Shad with nothing left to say.

The vixen looked at me and said, "What if I run? You two little pocket pips couldn't stop me."

"No, we couldn't," I answered. "In Houndtor Down Lodge this instant, though, equipped with the best riding stock and guided by the most competently trained hounds in the world, is an assembly of the most proficient and fanatical fox hunters in the world. You've never run before the hounds, doctor. You don't know how. I fear in a matter of minutes you and your unborn cubs would be cornered and most likely torn to pieces. Why not let a judge and jury decide your fate?"

"I can run faster than you can move. My human body can—"

"Your human body is dead, Dr. Wurple," said Shad.

Her eyes grew wide as she faced me.

"Carbon monoxide poisoning from your generator," I explained. "There was nothing we could do." I could see the defeat in her face as I turned away, sad for her.

She cooperated in exiting the burrow once PC Lounds arrived to caution her and make the arrest. He put her in a dog cage and drove off with her in the electric. There wasn't anything we could say to console Archie Quartermain. All we could do was to give him the number of a facilitator for an amdroid grief group, see to it that DCI Stokes released Lady Ida Bowman with all due apologies, and head back to Exeter, the sun actually making it through the clouds for a minute before a new front came in and the rainfall resumed.

While we rode off into the truncated sunrise, I asked my new partner, "How would you like to be on that jury, Shad? He was the fantasy love of her life, and the price of her union with him was she'd have to remain helplessly by while he was killed over and over again. What to do?"

"We just catch 'em, Jaggs. We don't cook 'em."

"Indeed, Shad. Too bad we resolved things so quickly, though. I really wanted to meet Dorothea Tay. Back in the dim reaches of time, I fear she was my childhood heartthrob."

After a moment of silence, Shad said, "Speaking of old movies, *The Maltese Falcon* was a script Archie and I had memorized front to back. 'I'm sending you over.'" He chuckled and said with Humphrey Bogart's voice, "'When a fox's partner's killed, he's supposed to do something about it.'" He glanced at me and said in his own voice, "Why did you let me go on like that?"

"My dear chap, I never would have dreamt of deprivin' you of your moment of triumph."

He frowned, regarded me with one dark eye, and said, "*The Scarlet Pimpernel*, Anthony Andrews vid remake, nineteen eighty-two."

"Quite right," I said as I beamed at my new partner. "Excellent." ■

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Science Fact

The Interstellar Conspiracy

Les Johnson & Gregory L. Matloff

Interstellar travel is (no pun intended) a long way off—but the first steps may already be underway.

What if . . .

If we were designing a human-carrying starship that could be launched in the not-too-distant future, it would almost certainly not use a warp drive to instantaneously bounce around the universe, as is done in Isaac Asimov's classic *Foundation* series or in episodes of *Star Trek* or *Star Wars*. Sadly, those starships that seem to be within technological reach could not even travel at high relativistic speeds, as does the interstellar ramjet in Poul Anderson's *Tau Zero*. Warp speeds seem to be well outside the realm of currently understood physical law; proton-fusing ramjets may never be technologically feasible (Matloff, 2000). Perhaps fortunately in our terrorist-plagued world, the economics of antimatter may never be attractive for large-scale starship propulsion (Mallove and Matloff, 1989).

But interstellar travel will be possible within a few centuries, although it will not be as fast as we might prefer. If humans learn how to hibernate, perhaps we will sleep our way to the stars, as do the crew in A. E. van Vogt's "Far Centaurus." However, as discussed in a landmark paper in *The Journal of the British Interplanetary Society*, the most feasible approach to transporting a small human population to the planets (if any) of Alpha Centauri is the worldship (Bond and Martin, 1984). Such craft have often been featured in science fic-

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tion. See, for example, Arthur C. Clarke's *Rendezvous with Rama* and Robert A. Heinlein's *Orphans of the Sky*.

Worldships are essentially mobile versions of the O'Neill (1974, 1977) free-space habitats. Constructed mostly from lunar and/or asteroidal materials, these solar-powered, multi-kilometer-dimension structures could house ten thousand to one hundred thousand humans in Earth-approximating environments. Artificial gravity would be provided by habitat rotation, and cosmic-ray shielding would be provided by passive methods, such as habitat atmosphere and mass shielding, or magnetic fields (Johnson and Holbrow, 1977). A late twenty-first century space-habitat venture might support itself economically by constructing large solar-powered satellites to beam energy back to Earth.

But how might a multi-billion-kilogram space habitat be propelled if its inhabitants choose to attempt an interstellar migration without antimatter, ramjets, or space warps? A landmark paper by Dr. Anthony Martin, who currently edits *The Journal of the British Interplanetary Society*, addresses this issue (Martin, 1984). Gravity-assist maneuvers using the giant planets may be used to fling a spacecraft toward the stars, as has been demonstrated by our first extrasolar probes, *Pioneer 10/11* and *Voyager 1/2*. Unfortunately, this is a time-consuming technique—about seventy thousand years would be required by the fastest of these vehicles to reach Alpha Centauri, if any of them happened to be traveling in that direction.

If interstellar migrants intend to cross the forty trillion kilometers between the Sun and Alpha Centauri within a millennium or so, there are only two propulsion systems that currently appear promising. These are nuclear-pulse propulsion and the ultra-thin solar-photon sail unfurled as close to the Sun as possible.

The nuclear-pulse rocket, which is derived from the DoD/NASA *Orion* Project of the 1960s, would ignite nuclear or thermonuclear "devices" as close as safely possible to the spacecraft. A properly shielded combustion chamber would reflect explosion debris, thereby propelling the spacecraft by Newton's Third Law. As demonstrated by Dyson (1968), a thermonuclear Orion could propel a worldship on a voyage of less than 1,300-year duration to Alpha Centauri, if the world's nuclear powers agreed to sacrifice most of their thermonuclear arsenals. Fat chance!

A somewhat sanitized nuclear-pulse starship, Project *Daedalus*, was studied by a British Interplanetary Society team during the 1970s (Bond *et al*, 1978). *Daedalus* would have been propelled by electron-beam-initiated explosions of fusion micropellets. The fusion fuel of choice was a combination of deuterium and helium-3. Although theoretically capable of accelerating a large starship to 10 percent of the speed of light (0.1c), the *Daedalus* concept was hampered by the terrestrial rarity of helium-3. Unless we can mine this isotope from a cosmic source—the solar wind, lunar regolith, or giant-planetary atmosphere—*Daedalus* would not be a practical solution to starflight.

Another disadvantage to nuclear-pulse propulsion is scaling. No matter whether the payload is a billion-kilogram worldship or a 10-kilogram microprobe, the propulsion system will still be enormous.

The remaining interstellar option—the solar sail—is quite scalable, which is a good thing for the budgets of present-day sail experimenters. The concept of interstellar solar sailing was developed independently by two teams in the late '70s and early '80s. Chauncey Uphoff of NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California, considered this as an alternative propulsion method for the NASA Thousand Astronomical Unit (TAU) extrasolar probe study, but his work was only incorporated into that

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study as an "unpublished memo" (Jaffe *et al*, 1980). In a series of papers beginning in 1981, Gregory Matloff and Eugene Mallove presented various aspects of this propulsion option in the peer-reviewed literature (Matloff and Mallove, 1981, 1983).

As described in the cited references, an interstellar solar sail would approach the Sun as closely as possible with the sail either directed away from the Sun or otherwise protected from solar radiation pressure prior to perihelion. At perihelion, the sail would be partially or fully unfurled and exposed to sunlight, accelerating the solar sail by the radiation pressure of solar photons.

Analysis revealed that if ultra-thin (20-30 nm), space-manufactured, all-metal sails are used with perihelion passes that are as close to the Sun as physically possible (within about 0.04 AU of the Sun's center), and if the cables joining sail to payload approximate the tensile strength of an industrial diamond, even large payloads could be accelerated in this manner towards Alpha Centauri on trajectories requiring about one thousand years. After acceleration (at 1 g or higher), cable and sail could be wound around the habitat section to provide extra cosmic-ray shielding. Assuming the space-manufactured sail has a very long lifetime in the galactic environment, sail and cables could also be used again for deceleration at the destination star system (Matloff, 2000a).

Of course, we could not construct such a starship today. But a NASA project—the In-Space Propulsion (ISP) Technology Project—is gaining knowledge about sail films and structures, high-acceleration operation of gossamer structures in space, and the application of ultra-thin filaments that could lead to the development of sail cables. Since this capability is being developed to support modestly funded science missions, not voyages of interstellar colonization, the work of ISP may be thought of as an "interstellar conspiracy," by which means humanity is developing an interstellar capability almost as an afterthought.

What is . . . The In-Space Propulsion (ISP) Technology Project?

Managed at the NASA Marshall Space Flight Center in Huntsville, Alabama, the In-Space Propulsion (ISP) Technology Project is an outgrowth of the NASA "Interstellar Initiative" of the late 1990s. The initial ISP research concentration was on propulsion systems, such as current-technology Earth-launched solar sails unfurled 0.2—0.3 AU from the Sun, that would enable *in situ* exploration within a few hundred AU of the Sun on missions of a few decades duration (Johnson and Leifer, 2000). The purview of ISP has since been expanded to include propulsion systems that could enable or enhance all scientific space missions under consideration by the NASA Science Mission Directorate with destinations above low-Earth orbit (LEO).

Most technologies considered by ISP researchers are approaching flight readiness, although some attention in the past was devoted to more speculative, higher-risk propulsion concepts with potentially high payoffs, such as plasma sailing (Lai, 2004). A prioritization system has been developed by ISP to match in-space propulsion technologies with planned or proposed space missions in an effort to pace their development so they will be ready when needed.

Six in-space propulsion technologies dominate the ISP research spectrum. These include advanced chemical propulsion, advanced solar electric propulsion (SEP), aerocapture, solar photon sails, solar thermal propulsion (STP), and tethers.

Advanced Chemical Propulsion

Today's chemical rockets are approaching their practical and physics-driven limits. To maximize the scientific return from space probes designed to

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descend for landings on planetary surfaces or ascend from such surfaces to return samples to Earth, a number of improvements to chemical rocket technology are under study and development.

Goals of this research include increased performance and safety, reduction in propellant storage uncertainties, and improved system efficiency. As well as advanced chemical fuels, researchers are investigating improvements in cryogenic fluid management to improve the efficiency and handling of cryogenic components. Another high-payoff improvement would be the reduction of the mass and complexity of structures utilized to carry and transfer propellants. While advanced chemical propulsion systems would not be applicable to interstellar voyages, this evolutionary technology could enable more ambitious exploration of our Solar System.

Advanced Solar Electric Propulsion (SEP)

Also called the "ion drive," solar electric propulsion works by using collected solar energy to first ionize and then accelerate propellants to exhaust velocities considerably higher than the 4.5 kilometers per second (km/sec) exhaust velocity of state-of-the-art chemical fuels. The exhaust velocity of the ion engine aboard the highly successful NASA Deep Space 1 probe was about 30 km/sec. The best SEP propellants are inert gases such as xenon and krypton.

Although high velocities are possible using SEP (and its nuclear cousin NEP), ion drives have low thrust and will always be utilized in space, never for Earth-to-orbit transportation. A number of improvements are planned to increase the performance of future SEP-propelled interplanetary probes.

One approach seeks to reduce the complexity and increase the operating lifetimes of SEP systems. To meet these needs, laboratory demonstrations of Hall-effect thrusters are currently underway. This will allow efficient SEP operation on missions significantly more challenging than previously flown.

Researchers are also working on methods for increasing the exhaust velocity of next-generation SEP to around 50 km/sec. Because of the higher exhaust velocity, fuel requirements for a given mission using next-generation SEP will be reduced, which also promises to increase the scientific payload mass.

Increasing the efficiency of ion thrusters will result in longer-duration SEP missions farther from the Sun, some of which may serve as interstellar precursors.

Aerocapture

Aeroassist technology has been used since the early days of space travel. Every Earth-returning capsule and the space shuttle have applied the atmosphere as a drag brake and thereby greatly reduced the requirement for reentry fuel.

A related technology is aerobraking, whereby a spacecraft in an elliptical orbit around a planet with an atmosphere dips into that planet's atmosphere repeatedly, to gradually circularize the orbit and decrease the spacecraft's distance from the planet.

An interplanetary spacecraft will be able to use the new technology of aerocapture to become a satellite of a planet by performing a single pass through its atmosphere.

Current aerocapture research under ISP emphasizes integrating a low-mass aeroshell with a thermal protection system and the development of aerocapture instrumentation. Various advanced aerodynamic decelerators are under consideration for aerocapture missions, including rigid structures, trailing and attached ballutes (a ballute is a combination balloon and parachute), and inflatable aeroshells. Figure 1 illustrates the different technology approaches for aerocapture.

Aerocapture is a fast maneuver, with a spacecraft decelerating from inter-

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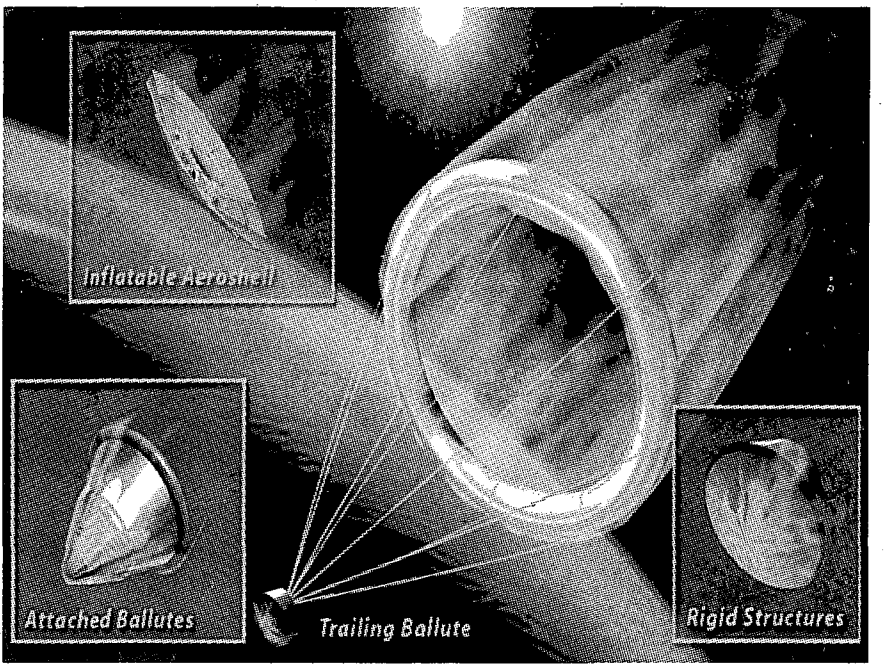

Figure 1

planetary to orbital velocity within one orbital pass. Decelerations in some cases are higher than 1 g, and knowledge of the destination planet's atmospheric profile is required to optimize the aerocapture trajectory.

Other than the Earth, a number of Solar System bodies have atmospheres dense enough for aerocapture. These include Venus, Mars, Jupiter, Saturn, Titan, Uranus, and Neptune.

Advances in aerocapture technology could quicken the development of aeroshells of lower mass and greater thermal tolerance. One can imagine advanced aerocapture missions decelerated by Neptune's atmosphere for rendezvous with Kuiper Belt Objects (KBOs) near the giant planet (Matloff, 2000b, Matloff and Taylor 2003). As aeroshell mass is reduced, the propulsion mass will also decrease since aerocapture greatly reduces the requirement for deceleration fuel.

* * *

The Solar Photon Sail

ISP solar sail research concentrates upon near-term Earth-launched solar sails with a typical areal density of 0.015 kg/m^2. Operational near-term sails will be stowed for launch and unfurled in space. Unlike the ultimate space-manufactured metallic sails, these are generally tri-layered. A plastic substrate is sandwiched between a reflective layer facing the Sun and a rear emissive layer that radiates absorbed solar energy.

As well as investigating low-mass materials and supporting structures, ISP sail researchers are considering methods of propellantless guidance, navigation and control, and developing relevant computer codes. Ground validation of deployment techniques for sub-scale sails is currently underway.

The solar sail requires no propellant (since thrust is provided by linear momentum transferred from impacting solar photons) and has no environmental impact. Unless efficient methods of

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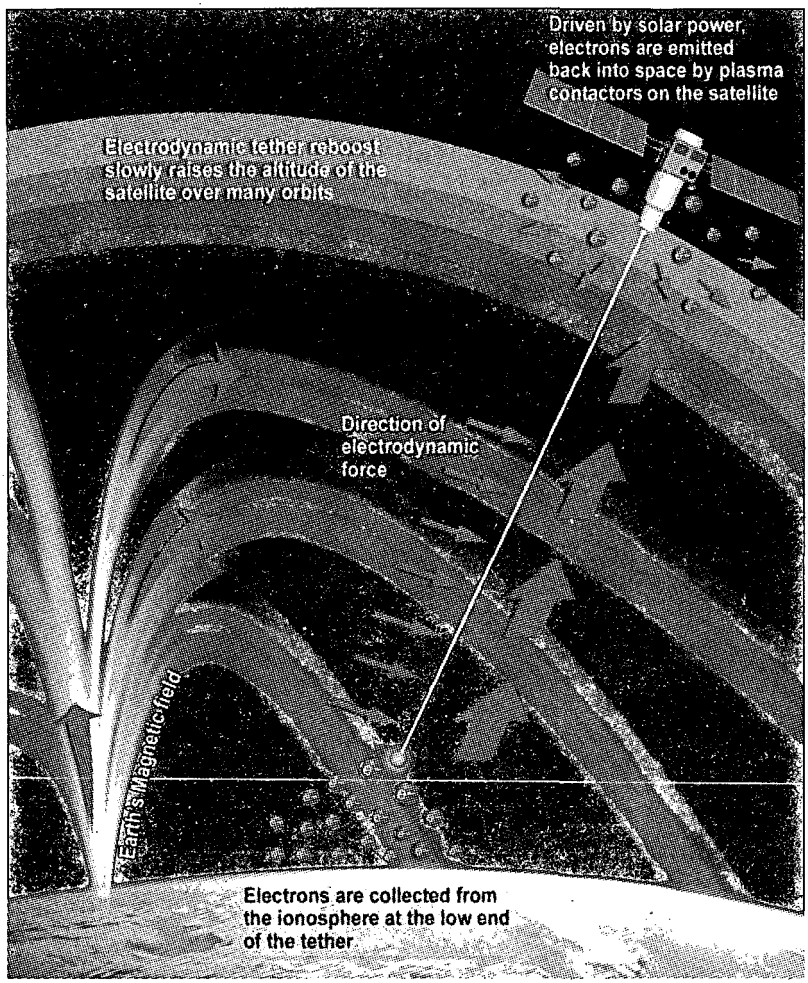
Driven by solar power, electrons are emitted back into space by plasma contactors on the satellite
Electrodynamic tether reboost slowly raises the altitude of the satellite over many orbits
Direction of electrodynamic force
Earth's Magnetic field
Electrons are collected from the ionosphere at the low end of the tether

Figure 2

power beaming are developed (Forward, 1984), sail technology will find most application on inner-Solar System missions where sunlight is most intense.

Near-term missions that may be enabled by the solar-photon sail include pole sitters permanently situated over high-latitude locations (McInnes, 1999) and constellations of solar observatories situated sunward of the Earth on long-duration missions to monitor space weather.

Although thin-film and inflatable structures have been unfurled in space, no dedicated solar sail mission has flown to date. The first NASA-launched sail may fly before 2010.

Solar Thermal Propulsion (STP)

Solar Thermal Propulsion is another in-space propulsion system that can live off the interplanetary land. This propulsion technology operates by focusing sunlight on a gaseous propellant, such as hydrogen (Shoji and Frve, 1988, and Grossman and Williams, 1990). Concen-

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trated sunlight is focused upon an absorbing heat-exchange system for transfer to the propellant. For efficient operation, the propellant is heated to temperatures as high as 2780 Kelvin. Exhaust velocities of the heated fuel are intermediate between chemical and solar electric propulsion, typically 8 to 10 km/sec. Although STP does not have sufficient thrust for ground-LEO operations, the technology could transfer a payload between LEO and geosynchronous orbit (GEO) in about 30 days.

Research on this propulsion system deals with a number of issues, including solar-concentrator design. Both inflatable and rigid concentrators are under consideration, although inflatable concentrators are currently favored.

Tethers

Of all the near-term in-space propulsion technologies, the tether seems the most magical. Imagine—all an Earth-orbiting spacecraft has to do to raise its orbital height is to unwind an appropriately designed long, thin cable! Both electrodynamic (ED) and momentum exchange/electrodynamic reboost (MXER) tethers may be used for propulsion in the future.

Electrodynamic tethers have been described by Samanta *et al* (1992), Beletskii and Levin (1993), and Estes *et al* (2000). They have also been demonstrated in space by the NASA Tethered Satellite System mission in 1996. To boost a LEO spacecraft using an ED tether, a long conducting strand is deployed downward from the spacecraft. Electrons are collected from the Earth's upper ionosphere at the low end of the tether. Powered by energy obtained from the spacecraft's solar array, the collected electrons travel up the tether and are emitted at the spacecraft. The resulting electrodynamic force on the unidirectional current adds energy to the spacecraft's orbit, thereby raising the orbital height. Figure 2 describes the electrodynamic boost process.

As described by Sorensen (2001), the MXER tether is a hybrid ED/momentum-exchange tether. A rotating momentum-exchange tether can increase a payload's orbital energy by grappling the payload at the low point of the tether's rotation and releasing it at the high point. However, the orbital energy of the tether itself decreases during this maneuver, and its orbital height is consequently lowered.

A rotating MXER tether has its rotation timed so that the tether tip is oriented below the tether-system center-of-mass and is swinging backwards at the perigee of its elliptical orbit. A payload from a LEO or sub-orbital launch is captured by a grapple on the lower tether tip at zero relative velocity and released at the high point of the tether's rotation. In theory, payloads could be accelerated to escape velocity in this fashion.

Left to its own devices, the MXER tether's orbit would decay after each payload capture and release. But if the MXER tether can also operate as an ED tether, electrodynamic forces on the unidirectional current flow can be used to raise the tether-station's orbit.

Much analytical work remains to be done to demonstrate the feasibility of this concept. But the MXER tether has the potential to revolutionize interplanetary space travel.

Ad Astra
Implementing an Interstellar Capability

At this point in space history, routine Earth-to-orbit travel remains a major challenge. But the Moon, Mars, and more remote destinations draw our attention outward. The propulsion technologies described will positively impact the development of the space infrastructure required to support an expanding interplanetary and, ultimately, interstellar human civilization.

Certain requirements for the expansion of human civilization beyond the Earth—understanding and mitigation of

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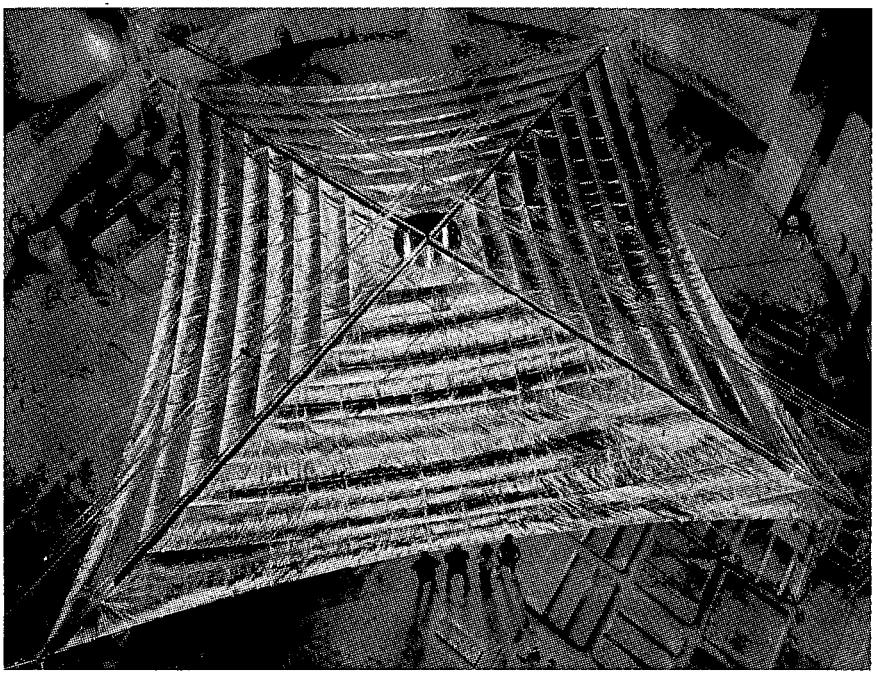

Figure 3

space-radiation effects, determination of optimum artificial gravity levels, development of closed-environment systems, etc.—will be satisfied by experiments aboard the International Space Station, or in conjunction with the next phase of exploratory missions above LEO. These will not be further discussed in this article.

Application of new propulsion technologies will have many positive effects in the development of an interplanetary (and ultimately interstellar) civilization. One requirement for such a civilization is expanded knowledge of the resource base of the Solar System. Advanced chemical rocketry, solar electric propulsion, and aerocapture should result in more massive and flexible scientific payloads to acquire this knowledge.

As well as reducing the cost of orbital transfer, development of solar thermal propulsion should assist the development of space mining and construction. Focused sunlight from the STP concentrator optics will provide an intense energy source for these applications.

Advances in chemical rocket technology may lead to the construction of spacecraft components directly from extraterrestrial resources. Such construction might be implemented by Rapid Prototyping (RP), which is the three-dimensional equivalent of a fax (Doyle, 2000). After a prototype is designed by a computer-aided design package, the RP machine quickly constructs the prototype layer by layer, conceivably using extraterrestrial resources as the feedstock. Perhaps this technique will be applied to the in-space construction of the ultrathin solar-photon sails required for interstellar travel.

As discussed by O'Neill (1974, 1977), SEP research may lead to the development of the mass driver. These solar-powered electromagnetic catapults could transfer large quantities of material from space mines to space manufacturing facilities.

The ultimate design of robotic or

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crewed solar sail starships will be served by current research. In addition to the in-space fabrication of ultra-thin sail films, starship designers will require thin, strong cables connecting sail and payload and demonstration that the ship can operate in the high-temperature, high-acceleration environment of a close solar pass.

Finite-element computer models indicate that several sail configurations remain stable for accelerations as high as 2.5 g (Cassenti *et al*, 1996). Tethers will yield experience with the operation of cable-like structures in space. Some aeroshell designs decelerating in planetary atmospheres will simulate the near-Sun acceleration of solar sail starships.

During the summer of 2005, the ISP team completed full deployment and thermal vacuum testing of two 20-m solar sails (Figure 3).

To those who witnessed the deployment, it was clear that the idea of interstellar travel is beginning to emerge from the theoretical paper and the science-fiction story into the realm of system engineering. Perhaps within the lifetimes of many *Analog* readers, humanity's first robotic interstellar emissaries will be sailing the interstellar seas. Although we will not witness them, we can dream of the expeditions to follow, which will carry people to the stars.

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The authors will soon see their book, "Living Off the Land in Space," published later this year by Praxis and Copernicus.

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Prevenge

Mike Resnick &
Kevin J. Anderson

Being a person of firm principles has its pitfalls. . . .

It wasn't the murders themselves that broke his heart. They weren't permanent. He had the ability to undo something as simple and straightforward as a murder.

No, the maddening part was that people never stopped *trying*. Why was the total, cold-blooded obliteration of a human life the preferred problem-solving method for so many men and women? It offended his deep moral sense.

His name was Kyle Bain, and he and the other members of the Knights Temporal had to make things *right*, either before or after the fact.

Kyle couldn't help wondering about the killers whose crimes he was assigned to negate. *You had a good start in life; you had money, education, opportunity. Where did it all go wrong?*

Or you—you had love, and now you'll never have it again. Do you know what a rare gift you threw away, just like you'd throw out the garbage every morning?

Or this current case: Vincent Draconis, a major industrialist who controlled an empire on three continents. He had been/would be murdered in one unguarded moment, leaving a widow and three fatherless children. The confusion in the aftermath would cost almost twenty thousand people their jobs. So much suffering.

That couldn't be allowed. It was a situation made to order for the Knights Temporal. . . .

Kyle arrived in the afternoon, ten hours before the murder was due to occur. According to the file, Draconis was going to be shot down in cold blood just before midnight while working late at his office. Even without witnesses, the man immediately fingered for the crime was Jason Bechtold, vice president of one of Draconis's companies.

Dressed just like the hundreds of other businessmen entering Bechtold's suite of offices, Kyle gained access to the correct, bustling floor. If he followed

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Bechtold as he left for the day, he could be there later on in time to deflect the murder. A simple enough job, one for which he was well trained.

The Knights Temporal had been founded by Harvey Bloom, a name that hardly seemed destined to go down in history, though Bloom had already placed his name in a thousand alternate histories, maybe more. A theoretical mathematician, Bloom spent the first half of his professional life finding the secrets hidden in Einstein's Special Theory of Relativity, and the second half acting upon them.

Bloom was also a moralist, more interested in Doing Good than in Making A Fortune. Instead of taking out patents or using his privately-funded "temporal displacement" work to study the past, Bloom knew in his bones that he had an obligation to right wrongs. And the most unforgivable wrong, commandment number one, was Thou Shalt Not Kill. When he recruited twenty-five Right-Thinking young men and women to be his crusaders, he made sure they all shared his moral values.

Thou shalt UN-kill, whenever possible.

After reviewing the file of Vincent Draconis's murder, Kyle waited and watched. When Bechtold emerged from his office late in the day, Kyle discreetly followed him out of the building, then in a cab, to where the executive met an elegantly dressed young woman at an expensive restaurant; they kissed, and a head waiter led them to a table.

Kyle holed up in a coffee shop across the street, nursing his small coffee and nibbling a cheese Danish. After an hour he could sense some irritation from the waitress, so he tipped her twenty dollars to leave him alone. He knew that right now, in the restaurant across the street, Jason Bechtold must be planning the murder of his boss, though he didn't seem particularly agitated. *Cool customer.* Establishing an alibi.

Kyle would block him before he could get to Draconis's office late at night. A subtle intervention was best, and if done properly no one would even notice. Waiting too long, cutting too close to the murder event, often raised awkward questions and suspicions.

Bechtold and his lady emerged from the restaurant at ten, and Kyle hastily tagged along, invisible in the street crowds. The woman was swaying slightly as they casually entered a five-star hotel. Nothing in the executive's behavior gave any hint of his murderous intent.

According to the file, Bechtold's defense was that he'd spent the night with this woman in room 2145. If she was sound asleep—from a tranquilizer slipped in her drink, perhaps?—and Bechtold was back in bed before she woke up in the morning, she'd corroborate his story.

After giving them ample time to reach the room (considering the way the lady was hanging on Bechtold's arm, Kyle didn't think the executive would be leaving soon) he rode the elevator up to the twenty-first floor and posted himself a few feet from the door to 2145. He sat down on the corridor's plush carpeting and waited. And waited.

And waited.

Past time for the murder. Kyle hadn't done anything at all; had he somehow intervened without knowing it? He knew Bechtold was still in the hotel room, but Draconis was supposed to be dead by now.

He took a cab and raced to the industrialist's office. The door was locked, but any Knight Temporal had the experience and tools needed to bypass security systems, no matter how sophisticated they might be.

When he opened the door, he stared down at the corpse of Vincent Draconis. Shot in the head, with blood pooling on the plush new carpet.

This was Kyle's thirty-fifth case, twenty-seven of which had been successes. On seven occasions Time, or Fate, or God, or some combination of them, had conspired to prevent history from being

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changed. But Kyle wasn't finished yet.

If a Knight Temporal couldn't prevent the murder, he was authorized to use his own judgment. He could give up and go back home, he could try again to prevent it—or, as a last resort, he could give the victim an opportunity to take preventive action. *Prevenge.*

Only twice in all of his cases had Kyle resorted to that option. With the greatest reluctance, he had allowed the victim to kill his would-be murderer before the fact.

Now that he knew Bechtold wasn't the guilty party after all, Kyle turned to the most distasteful aspect of his job: He would have to *watch* the murder happen and work backward from there.

Turning away from the corpse, he studied the office, discarding various hiding places. The coat closet looked small and cramped, and crouching behind the large decoy safe (the real one was behind a painting in the outer office) felt too exposed. Kyle chose Draconis's private bathroom as the best place to observe. He pulled the door almost shut, leaving only a narrow gap. From here, he could see both the office door and the desk.

He pulled out his PDA-look-alike temporal transformer, programmed in the proper coordinates—and promptly experienced the moment of dizziness that accompanied each brief jump. When the fog cleared from his brain he checked his watch: 11:25 P.M.

Through the crack in the door, he could see a very-much-alive Draconis pulling up various screens of information on his computer and taking an occasional sip from the highball on his desk. He hoped the man wouldn't need to use the bathroom before the time of the murder. Explaining his presence wouldn't be easy, and Kyle preferred not to use his ace-in-the-hole proofs if he didn't have to.

Five minutes passed, then fifteen. Not long now. Draconis didn't look the least bit worried. So the killing was going to be totally unexpected.

An elderly woman entered the office, pushing a cart filled with towels, rags, brushes, feather dusters, and cleaning fluids. Her hair was gray, her face heavily lined; osteoporosis and long years of hard work bent her over.

Draconis never glanced up from his computer, grumbling about his spreadsheets. The cleaning woman didn't seem to exist for him, and he paid no attention when she locked the office door. Kyle's eyes were wide as the old woman reached into an empty bucket and withdrew a handgun.

"Look up, Vincent," she said harshly.

He finally bothered to notice her. "Who the hell are you?"

"You really don't know, do you?"

He saw the gun. "If this is some kind of joke . . ."

"This is no joke, Vincent. I'm going to kill you."

He gave her a withering look, showing no fear at all. "Who *are* you?"

"You have all eternity in hell to figure it out." She pulled the trigger.

Kyle had not expected her to act so swiftly, so coldly. He didn't have a chance to intervene. Already too late! Two strikes in one night. He made no sound in his hiding place. If the woman panicked and shot *him*, he'd have no way to slip back in time and prevent his own murder.

Draconis lay in a bloody mess on the new carpet. Moving in a daze, as if wondering whether she should clean the office after all, the old woman unlocked the door and slipped away.

Stunned, Kyle wasn't sure what to do next. Now that he knew the real killer, he needed to find the woman's name and address. He had less than fifteen minutes before a night security guard was due to discover the body, and the place would be crawling with cops.

He needed more time to plunder the files, and fortunately he could buy all the time in the world. Without leaving the office, Kyle made the calculations and

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adjustments and jumped back a few days.

The cleaning woman was Bertha Gilligan, age sixty-three, widowed, mother of one. She'd applied for a job as a night cleaning woman less than a month ago—clearly with the intent of killing Draconis.

Late at night, when Bertha was at work, Kyle slipped off to her dingy room in what could only be called a flophouse. He needed to learn something about her.

Two small cats greeted him, purring and rubbing against his legs. He saw the opened can of cheap generic cat food covered by a plastic wrap with a teaspoon next to it. Two open cans on the floor were for the cats; this other can must have been for Bertha herself. The kitchenette had no refrigerator, only a hot plate; the shelves contained a few packets of dirt-cheap ramen noodle soup and one box of off-brand macaroni and cheese.

On the nightstand he found a row of medication bottles. Pills for pain, pills for depression, pills for half a dozen serious physical ailments. Behind the bottles was an extensive photo display of a lovely blonde woman in her mid twenties. The cleaning woman's daughter?

A battered wooden table doubled as a desk. One leg was shorter than the others, propped up with a paperback book. On it were a scrapbook and a notebook. Kyle couldn't have asked for more.

The scrapbook began with a few news items about one Edward Gilligan, a distinguished-looking man, graying at the temples, with frameless glasses and a thin mustache, a natty dresser. He'd created some nearly frictionless compound the experts estimated would extend the life of heavy machinery by 50 percent.

Kyle kept thumbing through the book, and the tenor of the news items changed. Vincent Draconis had managed a hostile takeover of Gilligan's company, appropriated the formula, and fired Gilligan. Gilligan had sued, but Draconis had the best lawyers and (it was implied) owned the judge; Gilligan had not only lost, but went broke in the process. The last page was an announcement of the untimely passing of Edward Gilligan, who had taken his own life.

Next, the notebook consisted of a series of letters, all of them addressed to Draconis, all signed by a Naomi Gilligan—no doubt the blonde girl in the photos. She accused Draconis of persecuting her father; she pleaded with him, she argued with him, she threatened him. The dates on the letters abruptly ended three months ago.

Kyle neatly replaced both books, finished his examination of the room, and left.

Later, at a library terminal, he scanned internet records and news databases for Naomi Gilligan. He wasn't surprised to find her obituary in an eleven-week-old paper. She'd been beaten to death in an apparent mugging.

Following the trail, he used his device and jumped back to the night of Naomi's murder. She was found dead in the park, her head staved in. From the position of the body and lack of blood on the scene, it was obvious even to a clumsy amateur detective that she had been killed elsewhere, and her body dumped out here. Considering that Naomi's purse—with money and credit cards intact—turned up in a trashcan about a mile away, Kyle had more than enough reason to doubt the simple "mugging" explanation.

Bodies went to the coroner, not the police station, but cops talked. He posted himself at the district station and kept his ears open. Within a few hours, jumping back and forth with his temporal adjuster, he had all the information he was going to get.

When the crime lab dusted Naomi's purse for prints, the mood in the station

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changed. Kyle overheard one of the cops whisper "Vincent Draconis!" and they all looked scared as hell. Somebody phoned Draconis and told him that they had a little problem and he'd better come down to the station. Obviously, it was payoff time.

Why hadn't one of the Knights Temporal been sent back to prevent Naomi's murder? But Kyle knew the answer: Harvey Bloom simply didn't have enough manpower, and he had to choose the crimes with the most impact . . . one of the few concessions he made to his otherwise rigid moral code.

Kyle cut off those thoughts before he could start to obsess on the conundrum. Preventing Naomi's murder wasn't his function. Like it or not, his assignment was Vincent Draconis.

Back to the night of the murder, one more time.

Bertha showed up for work at nine o'clock. What he'd learned certainly explained why she wanted to kill the man who had ruined her husband and murdered her daughter. But Kyle was not a judge; he despised "situational morality," people who changed their minds with the blowing of the wind. The law was a framework, not a convenient set of suggestions.

According to her established habit, Bertha took her break at eleven; doubtless that was when she planned to plant the gun in the bucket. Kyle waited until she went to the small lunchroom. He watched her moving more mechanically than usual, stumbling through the motions. When she sagged into a plastic chair and poured herself watery coffee from a thermos, Kyle carefully, silently, locked the breakroom door so that she wouldn't be able to leave for her murderous rendezvous. He posted himself just outside the room, ready to accost her if she somehow managed to get out.

But the door remained locked. He didn't even hear her rattling to get out. Finally, at a quarter to twelve, he slipped upstairs to make sure that Draconis was still working at his desk. The straightforward delay should have been enough to derail the killing. Case closed, mission accomplished.

But Vincent Draconis was sprawled on the floor, blood still seeping out of the fatal wound in his head, still ruining the carpet.

Kyle groaned when he discovered that the break room had a second door, which Bertha had used.

His next attempt to prevent the murder was to confront Bertha directly in the break room—but for whatever reason, she went straight upstairs and killed Draconis. Again.

This was getting complicated, one of those cases that seemed jinxed, as if Fate didn't want it to be fixed. For reasons that no Knight Temporal understood, certain actions simply couldn't be diverted.

Poor Bertha's only sin was to have married a man who'd stood in the path of a steamroller named Vincent Draconis. Her daughter had stood up for fairness and justice, and she had been killed. Bertha's life had been in a downward spiral, emotionally and physically—going from all the benefits of wealth and culture to that horrible room five blocks away, seeing two loved ones trampled into oblivion by an unethical bastard whose sole virtue was that he was stronger than anyone else.

But Kyle had to stop her. The rules were clear-cut. All Knights Temporal swore an oath. Moral gray areas were for the weak and indecisive, not for the agents of Harvey Bloom.

Kyle realized that his only alternative was to give the victim a chance for prevenge.

"Who the hell are you?" demanded Draconis when Kyle appeared in his office two hours before the scheduled murder event.

"My name is Kyle Bain—"

"Well, get your ass right out of here,

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Kyle Bain, or I'm calling security. In fact, a couple of them are going to get fired for letting you get this far."

"I'm here to save your life tonight."

Draconis made a rude snort. "What are you selling, religion or laxatives?"

"Murder prevention." He had already prepared the way for this man to believe his improbable revelations, planted his ace in the hole. Since Draconis was a secretive man, there were plenty of places Kyle could drop the necessary information—a hidden safe that even his wife and his most trusted aides didn't know about, private notebooks kept under lock and key. One or two "impossible" details would be enough to raise sufficient doubt.

Kyle explained briefly how and why he had come here, not expecting Draconis to believe his crazy time-travel story. "Go to the safe in the outer office. Open the ledger for July of last year. Turn to page three."

"What do you know about that safe?"

"Just do it, Mr. Draconis. We haven't got much time. If you try to sound the alarm on her desk, or the one on the way out of this office, I'll leave you to your fate."

Frowning, Draconis seemed about to ask something, then thought better of it. "You've bought yourself a few extra seconds, Mr. Bain. I'm intrigued." Kyle watched him dial the safe's combination, open the door, remove the ledger, and look at page three.

"If you need further proof," said Kyle, "call your house and ask your maid or your wife to bring your 1973 diary to the phone and read you the June 15 entry."

"I believe you—or at least I believe your tricks are highly sophisticated," said Draconis, looking down at the totally unexpected note in the ledger. "So, who's going to try to kill me?"

"She's going to do more than *try*, Mr. Draconis. Due to some temporal exclusion in this case, I myself have been unable to stop her. Therefore, it's in your hands. If I don't give you the wherewithal to take your prevenge, she's going to kill you. Tonight."

"All right. Who is she and what has she got against me?"

"We'll come to her name in a few minutes." Now that he knew Bertha, understood her anguish, Kyle felt cagey. "As for her motive, you ruined her husband."

"I've ruined a *lot* of people." Draconis made no attempt to keep the contempt out of his voice. "That's the way the game is played."

"It's the way *you* play it," replied Kyle distastefully.

"And I'm damned good at it. Look around you. I don't just work in this building. I *own* it, all thirty-four floors of it."

"How many people did you destroy along the way?"

"Business is Darwinian. Clear cut, black and white. There's meat and there's meat-eaters, nothing in between."

That's what Harvey Bloom always says about murder. It's clear cut, black and white. To feel sympathy for a killer is an insult to his victims. I wonder what he'd say if he knew how much he sounded like you?

Finally Kyle spoke. "Aren't you forgetting to include bystanders, advocates, families? The woman who's going to kill you has another grievance besides the fact that you ruined her husband."

"Yeah, they all do." Draconis was unimpressed, almost bored. "What's this one's?"

"Her daughter."

"What happened? Did she go into a nunnery?"

"No. Into a morgue."

Draconis shrugged. "Lots of people die. Half of them are somebody's daughters."

"Half of them haven't had their heads staved in by a person with your fingerprints."

Draconis frowned. "Yeah, I read in

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the papers that Eddie Gilligan's daughter was killed in the park. So tell me this, hot shot—if my fingerprints were found, why wasn't I ever charged with anything? I was out of town that week."

"No, you weren't. I was at the police station when they contacted you and arranged for the payoff."

"Have fun trying to prove it!"

"It's not my job to prove it. It's my job to prevent Bertha Gilligan from murdering you." He tried to sound firm, convinced. *Even if it'll destroy the last few scraps of her life . . . and even if you deserve it.* "Your office has new carpet, Mr. Draconis. I guess Naomi bled on the old one? Is this where you killed her, then dumped her body in the park?"

"You're really not a cop, even in the future?"

"I'm really not a cop." *Sometimes I just wish I was.*

"The bitch bled like a sieve." Suddenly he grinned. "She actually thought she could threaten me with a letter opener. Hell, she couldn't have weighed a hundred and ten pounds."

Kyle felt sick. "Why do so many people consider murder an effective solution to their problems? You could have just disarmed her and sent her away. Or reported her to your friends at the police station and gotten a restraining order."

"You think that would stop a psycho girl? She'd come back with a gun the next time. Anyone who threatens me had better make good on that threat, because I don't give second chances."

"The Darwinian rule of threats?"

"Yeah, now that you put it that way."

"I consider myself a moral man, Mr. Draconis. Law and ethics are the glue that holds our civilization together. Justice is blind, and murder is wrong. My job is supposed to be simple. *You* make it complicated."

Draconis looked at him with a sneer. "Oh, you're one of *those* types."

"I assume you short-change your partners, lie to your friends, cheat on your wife, and stiff the government on taxes." Kyle sighed wearily. "It's all Darwinian, when you get right down to it."

Draconis took a sip from the highball on his desk. "You don't like me much, do you?"

"Does anyone?"

"Probably not. But they sure as hell respect me."

"I think it's more likely that they fear you."

"Same thing." Draconis shrugged. "Look, hot shot, you just concentrate on keeping me alive and I'll take care of you. Vincent Draconis always pays for services rendered."

Except when you can get away with not paying. Aloud, Kyle said, "Doing my job well is payment enough."

There was a long silence. Finally, Draconis broke it. "So what do we do now?"

"Now we wait. She'll be here soon, and you'll have to prevent your own murder."

"You're telling me Eddie Gilligan's used-up widow is going to sneak past all my security and try to kill me?" He let out a contemptuous laugh.

"She won't have to sneak past anyone. She has every right to be here."

Draconis frowned for a moment, then looked up. "Cleaning service, right?"

"That's right."

"What's she like?"

"Probably like a thousand other people you wouldn't recognize by sight. She's been beaten down by circumstances—circumstances of your making. She's lost the two people she cares for, she's destitute, she's taking medication for pain and for depression, she lives in a dump, and she has only one goal left in her life—to kill you."

"That's *her* misfortune. No one will miss her, any more than they miss Eddie or her daughter. They're the roadkill of history. It'll be like she never existed." He picked up his highball glass, realized it was empty, and put it back down on his desk. "You know, I always figured if

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anyone had the brains and guts to take me out, it'd be Jason Bechtold. I keep the bastard under surveillance every minute he's near me."

"It just goes to show that you can't choose your killer any more than you can choose your family. Hell, they're lined up around the block to kill you. In fact, even if you stop her, that just means someone else with every bit as much reason to hate you will take you out next week or next month. And then I'll have this same case dumped in my lap again. Maybe it's just not worth the effort to stop your killer."

"Quit calling her my killer," said Draconis irritably. "She's my *would-be* killer, and she's about to become a piece of dead meat. Now, how does this work? You called it prevenge, so I assume I get to take my own pre-revenge and kill the bitch myself. Self-defense. You're just an interested bystander?"

"That's correct."

"So give me a gun. Or do I have to take care of that myself?"

"I have a gun for you—when the time comes. I've tried to prevent this three times, and it keeps happening. So no matter what I do, it looks like *someone's* going to get killed here tonight."

"You afraid I'll shoot you too?" Draconis seemed amused.

"I wouldn't put it past you," admitted Kyle.

"Why would I do something like that?"

Because it's your nature. Aloud, he said, "I'm a witness, and who's going to believe a story about a guardian angel from the future?"

"Then we sit and wait," said Draconis. "Just stay close enough that you can pass me the gun when the time comes."

Kyle pulled a leather chair next to the desk, sat down, and stared at the door. Right on schedule, Bertha Gilligan entered the room behind her pushcart. She seemed surprised to see two men confronting her.

"Hello, Bertha," said Kyle.

"You know my name?"

"I know a lot more than that. I know what you plan to do, and it's my job to stop you from killing him. Scum like Draconis isn't worth one second of prison time."

"I don't care about what happens afterward." Her face reflected her hatred. "You don't know what he did to my husband and my little girl."

"I know."

Startled, Bertha reached into the bucket and pulled out her gun. "You think my Naomi is the only person he ever murdered or had killed? You think my Eddie is the only man he ever hounded to the grave?"

"I know they're not."

"Stop talking and give me the goddamned gun!" yelled Draconis.

"Then why do you want to save him?" she asked.

"I'm not saving *him*, Bertha," said Kyle gently. "I'm saving *you*. You've suffered enough."

You were wrong, Harvey. The world's not black and white. It's twenty-three shades of gray. In fact, you were wrong about a lot of things. Sometimes it's an insult to the murderer to feel sympathy for his victim.

"My suffering doesn't matter," said Bertha. "He's got to die." She swung her gun, aiming at Draconis.

"He will," promised Kyle.

"How?"

"Like *this*." Kyle pulled his pistol and fired point-blank at Draconis's head.

"Jesus!" Bertha stared in rapt fascination as the man fell to the floor in the identical position that Kyle had initially seen him. "Jesus!"

"Get out of here, Bertha. He's dead. You have a life to live."

"Not much of one," she answered bitterly.

"If you don't make the most of it, then even in death he's won. Are you going to let a scumbag like that beat you even after he's been shot and killed?"

"Who *are* you?" she asked suddenly.

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"I'm the man who just gave you back the rest of your life. Don't make an Indian giver out of me. Go home and think about it. Security will be here any moment, and the cops won't be far behind."

"What about you?" she asked.

"I'll be fine. Now leave!"

She stared at him, then pushed her cart into the hallway and over to the elevator.

Kyle left the gun behind, covered with his own clear fingerprints (which, thanks to Harvey Bloom and a few simple jaunts back in time, were not in any database). That way, nobody would accuse Bertha, and of course Bechtold's alibi would hold up. When he heard the footsteps of a security guard running down the hall, he pulled out his temporal transformer, went forward to his own time, and walked out of the empty office.

Now *he* was a murderer. Even if the case baffled the cops, the Knights Temporal would solve it easily enough. Would Harvey Bloom order his termination? He couldn't imagine any circumstance under which Bloom wouldn't order his death.

But Bloom had a problem. Every Knight Temporal was a moralist, just as he was. Kyle wouldn't make any effort to hide from them. He'd simply explain the situation, the events that led to his action, and bet his life that they would understand. Situational ethics? Some of the Knights, he was sure, would volunteer to stay in the past and protect him from more of Bloom's operatives.

And then he was going to present Bloom with the same moral conundrum he himself had just faced . . . because even if one did manage to kill him, wouldn't Bloom's own rules allow him to take his own prevenge?

The thought brought an amused smile to his face. ■

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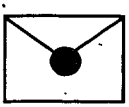

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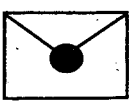

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Man, Descendant

Carl Frederick

All lives have dark moments, but some go deeper and last longer than others—a lot longer

"Only the engines matter. I'm never unaware of them. When they throb, I throb. When they complain, I worry, and when they're happy, droning like locusts on a summer afternoon, I feel content."

Conrad hit the "End Log Entry" button and a synthesized voice said, "Time stamp:

Explorer Clock: 12 February 2048—09:04. Capsule Clock, 12 February 2048—08:59." The computer monitor echoed it in text.

Yes, he had reason to be obsessed with the engines. This wasn't an everyday space jaunt where if the engines falter, you simply drift along until you fix them. These engines held his tiny craft motionless against the gravity of a 0.4-solar-mass black hole. Engine failure meant oblivion.

A chime rang over the thrum of the engines—mail call. Conrad returned his attention to the monitor and triggered the incoming message. He smiled, seeing the familiar faces of the Titan expedition crew—*his* expedition until a few months ago when he'd agreed to be pulled away to join his brother for the relativity experiment. But hearing the animated commentary from his former crewmates and seeing the great frozen vistas of Titan framed by the majesty of Saturn and its rings, he questioned his choice—his lonely choice.

The Librarian-scientist moved softly through the gallery, then stopped to experience the sculpture, "Galaxies in Collision." It was glorious: the lines, planes, the brilliant interplay between the angles of electric and magnetic fields. As he moved around the work, the field lines subtly changed, electric and magnetic in harmony. At other times the clash of the undulating fields, the angles between electric and magnetic, was staggering. Brilliant.

It was good being of the world

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again: signaling with others, going to museums, experiencing life. He'd been closeted away too long at the university, working on his translation.

The Librarian moved to the next exhibit, the alien sculpture—more than a sculpture. The electromagnetic interactions were primitive, yet strong and vibrant. The compact form spoke of a wondrous yet inaccessible culture. Concentrating on the piece, The Librarian quivered with regret. He did not see the Keeper approach.

"Is it really you?" signaled the Third Keeper of the Art. "Haven't seen you for many lesser-years. Does this mean your translation is finally done?"

"Yes," signaled the Librarian, radiating an aura of modesty.

"Splendid. I'd love to scan it. Could you show it to me—now?"

The Librarian understood that the request, although polite, was more in the nature of a command. One did not deny the Third Keeper.

"Yes, of course. Come."

They glided from the museum, then skimmed across the university to the Librarian's lab.

The Librarian took up the ancient artifact and patted it. Long ago he had been given the task of translating this most personal relic from the deserted ship. Carefully, he opened the cover of the alien document, immersing himself in its power, feeling the familiar link with the unknown creature that had written it.

The Third Keeper of the Art emitted a quivering field pulse.

"Oh, I'm sorry," signaled the Librarian. "After all this time, I'm afraid I've become obsessed with the alien craft."

"Did the alien's document tell how it happened to come to our world?"

"Only hints." The Librarian-Scientist reached for the translation cylinder and presented it to the Keeper. "The rendering may not be good but I hope it is at least coherent."

The Keeper assumed the static resting posture, popped the cylinder, and began scanning.

Entry 34
Explorer Clock: 14 April 2048—09:00
Capsule Clock: 13 April 2048—18:10

This journal is for you, Jennifer. I hope you'll want to read it when you're old enough to appreciate your father's line of work.

It's been three months since the launch. I spent the last two of them alone in this little probe ship that they call the *Time Capsule*, and the first month on board the mother ship with the others, including Mark, my twin brother.

NASA conceived the mission only two years ago—just after a compact black hole was discovered about a light-month from the Sun. It's hard to understand why it wasn't discovered earlier. But it is perpendicular to the plane of the solar system so its perturbation on the planets is slight.

NASA wanted a closer look and, with the new Richardson Field Effect engines, a spacecraft could get there in five or six weeks, and the Richardson Field would also protect the ship's crew from black hole tidal effects. The relativity experiment was a bonus.

We're attempting to verify Einstein's prediction that time runs more slowly near a black hole. I'm in the *Time Capsule* up close to the hole and Mark is farther away in the mother ship, the *Gravity Explorer*. Where I am now, it's a one-percent effect. But the plan calls for taking the *Capsule* in to the five-percent depth. So, after three months, I'll be about five days younger than Mark. They say they can measure that.

There's a clock here on the *Capsule* that lets me measure how my brother and I drift apart in age. It has two displays. One shows my local time and the other the time on the *Explorer*. It works by measuring the gravitational shift of the interstellar hydrogen-alpha line. (Forgive me, Jennifer. We astrophysicists talk

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like this.)

It's clear that the *Time Capsule* was a rush job, cobbled together from other craft. I smile whenever I think of the escape pods. Yes, pods. There are two of them, and that is quite silly considering this is a one-man mission.

I've got to admit, though, that the experiment itself is a little silly. They could have used an atomic clock or even a couple of dogs. But NASA funding these days is as much a function of the Public Relations Office as the Science Assessment Group.

Karen and Jennifer: I love you and miss you terribly. Exploring is a disease, but this mission is my cure. I'm sure of it.

"This is remarkable," signaled the Keeper. "Your annotations: are you comfortable with them?"

The Librarian exuded polite humor. "You mean the units of time?"

"Yes, actually."

"The spacecraft had a module, almost a handbook, for learning their language. And there was information on atomic spectra, and also basic properties of electromagnetic radiation—very fundamental data. But with them, we could convert their units to ours."

"Odd that the properties were recorded," signaled the Keeper, low, more to himself than to the Librarian. "One would expect any intelligent creature to know them almost from birth." He returned to the scan.

Entry 39
Explorer Clock: 21 April 2048—09:01
Capsule Clock: 20 April 2048—16:31

I just received a video transmission from Karen and Jennifer. I miss them terribly. Jennifer is about to start school and is bubbly with enthusiasm. Karen is suffering from empty nest syndrome.

It's maddening to get a transmission every day, and know that it was broadcast a month ago. Holding a conversation where it takes a couple of months for a simple exchange is hard. The speed of light is such a nuisance.

I'm lucky Mark is nearby on the *Explorer*. I need the conversation—and the companionship.

Entry 46
Explorer Clock: 28 April 2048—09:00
Capsule Clock: 27 April 2048—14:50

NASA has found a way for me to kill time. They're relaying TV programs to me via the *Explorer*. Watching them with my feet up on the console, I can almost forget where I am. Not that I want to, for space is beautiful.

I'm looking out my top viewport now, and I'm overwhelmed. The *Gravity Explorer* gleams white in the black of space. It is magnificent in its complexity. The antenna array, every conduit, every viewport, the docking bay, the engines: beauty. It looks like a painting. Against the unnaturally bright, point-sharp stars, it doesn't seem real. I've gazed at the sky almost every night since I was a kid. Stars should twinkle. In space they don't.

Only the slow movement of the *Explorer* against the field of stars lets me know that I'm not frozen in time.

"He has a sense of aesthetics," signaled the Keeper. "So like us, he is."

"I was sure of that," the Librarian responded, "when I first saw the sculpture in the museum—"

"Yes. Quite right."

"But then I discovered that the sculpture was not intended as such."

"Oh?"

"It's in the translation, Keeper."

"Ah. Then, I'll continue scanning."

The Librarian emitted a soft aura of art appreciation. "But, despite misunderstanding the sculpture, I do agree; the alien appreciated art."

Entry 51
Explorer Clock: 03 May 2048—09:02
Capsule Clock: 02 May 2048—13:42

My chess game is improving. Mark

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and I are pretty evenly matched, and we play for several hours each day. It helps fight the isolation and tedium. Despite the beauty visible through the viewport, it's hard to avoid boredom. I even find myself watching the relayed sitcoms.

I'm glad I have a good astronomical telescope on board. When I'm not making scientific measurements, I keep the scope trained on the *Gravity Explorer*. Just seeing its huge antennas aimed toward Earth makes me feel closer to home.

"I wonder what a sitcom is," signaled the Keeper.

"Not a clue. Something to do with aesthetics, I imagine. He also uses the notation 'TV' for it."

"Many of the entries are missing."

"He explains that in the journal," signaled the Librarian. "A failure of his technology."

"A pity. Completeness would be useful in a document this important to our cultural unity."

"Cultural unity?" The Librarian loosed a flash of surprise.

The Keeper emitted an avuncular aura. "You do know the Theon Council wanted to have the spacecraft destroyed?"

"But why?"

"Who can tell with Theons? They called it an abomination." The Keeper flashed tolerant humor. "I went over their heads to the Union of the People. I argued—successfully, I'm proud to say—that the destruction of the craft would be a desecration of art."

The Keeper radiated a blocking field, a discouragement to communication. Then he signaled, "But let me return to scanning your amazing translation."

Entry 54
Explorer Clock: 06 May 2048—10:40
Capsule Clock: 05 May 2048—14:36

The *Explorer* team has authorized me to take the *Capsule* to the five-percent time-dilation depth. I'm a little worried about the engines. Mark says I'm paranoid. I told him I'd like to be around to see my daughter grow up, and he just laughed.

I'm moving the *Capsule* deeper. The engines sound fine.

Entry 55
Explorer Clock: 07 May 2048—09:04
Capsule Clock: 06 May 2048—11:21

The Earth clock is moving faster than it should be. I've radioed to Mark, and they confirmed it. There has been an error—not a serious one. I've dropped to about the twelve-percent dilation effect.

I asked if I should move the ship back out a little. They calculated and said no. Either I use the engines to come all the way out, or stay where I am. Coming out a little and stopping would take too much power. Until they figure out exactly what happened, they'd rather I didn't touch anything.

So for the moment, I'll stay put and keep watch on the engines. They seem happy—purring like kittens. They get their fuel from matter falling into the black hole, and since the *Time Capsule* is a little deeper now, the matter density is higher. So the engines have less trouble sucking in fuel.

I'm almost three days younger than Mark now; he has taken to calling me "Kid Brother." Funny guy.

Time is running noticeably slower for me than for Mark. I notice he seems to be talking faster, and his voice is higher. To him, I must seem lethargic. I find I try to compensate by speaking rapidly and raising the pitch of my voice. Transmissions from Earth are also affected, of course, but the *Gravity Explorer* has signal processing equipment. They slow the transmissions down for me. I'm still able to watch the relayed TV programs without them looking like old silent films.

Entry 62
Explorer Clock: 14 May 2048—11:20
Capsule Clock: 13 May 2048—01:00

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I'm beginning to think of Mark as my superior. That's ridiculous. I guess it's because I'm so dependent on him now; he's my conduit to home. And he seems to be smarter than I am. When we play chess, he makes his moves more quickly and he thinks faster, reacts faster. I understand that this is just because of the time-dilation effect, and he's really no more agile than I am. But I can't help it. It *feels* as if he's smarter and faster.

Entry 63
Explorer Clock: 14 May 2048—14:19
Capsule Clock: 13 May 2048—03:18

What I've worried about has happened. The engines were getting too rich a matter influx and sputtered out. Luckily, I was able to spot the problem and cut down the flow. It only took seconds but even so, the *Time Capsule* sank down to about the 100-percent time dilation level.

This would be a good time to get out if I can. I've just thrown the engines to full power. I hope it works, but I won't know until I get a read from the *Explorer*.

The problem now is communications. I can't talk to the *Gravity Explorer* directly—our time rate difference is too large. Now we record our words and send them to each other as data files. But this layer of processing makes it all but impossible to have a simple back-and-forth conversation.

They say it will take them a couple of hours to calculate how the engines will perform at my current position above the black hole. I'll be nothing but nerves until I hear the results. But then, I'll only have to wait half their time. A small consolation.

While I'm waiting, I find it comforting to train my telescope on the *Explorer*. It looks bluer than normal, of course.

I can't help but concentrate on the sounds of the engines. Every little variation, real or imagined, sends my pulse racing.

Entry 71
Explorer Clock: 14 May 2048—19:29
Capsule Clock: 13 May 2048—05:53

I've just received news from the *Explorer*. My vessel will slide further in before the engines bring it to a stop—to the 300-percent level, they think. Worse, there is no way the engines have enough power to get me out. The *Gravity Explorer* can't do anything for me either. They're waiting for instructions from NASA, and it will take them two months to hear back. I'll only need to wait weeks. Little consolation!

I trust NASA, though. I've got to. They'll get me out.

I hate this.

Entry 73
Explorer Clock: 26 Jun 2048—05:37
Capsule Clock: 29 May 2048—06:05

I can't just wander my cramped quarters and do nothing—not without going insane. I'm studying up on the Richardson Effect. Maybe I can think of something. Sure, once NASA gets the news from the *Explorer*, they'll put everything they've got on it, but it's not life or death for them.

Entry 75
Explorer Clock: 30 Jun 2048—20:14
Capsule Clock: 30 May 2048—17:46

I can hardly cope with the torrent of data coming in from Earth now. When I'm not studying or sleeping, I watch transmissions from my wife and daughter. Jennifer is a little older each time I look at her. I wanted to be able to see her grow up, but not this way.

"It's hard not to feel compassion for the creature," signaled the Keeper, his attention locked on the translation cylinder.

"Very hard."

Entry 76
Explorer Clock: 02 Jul 2048—05:40
Capsule Clock: 31 May 2048—03:36

I've got an idea how to get out of this. Theoretically, it should be possible to di-

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vert power from the Richardson Field to the engines. This is touchy since if I divert too much, the field won't be able to protect me from tidal forces. If the field fails, it would be like dying on the rack—stretched for hundreds of miles—a nasty death.

I'm pretty sure I can build the control circuit to channel the Richardson Field. It won't be easy, though, as first I'll have to make the tools. Then before I even start building, I'll have to salvage field-programmable logic array chips from back-up computer boards—tiny surface-mount chips.

I've located the right computer board. It has an awkward triangular shape, but it'll do.

I don't think I'm going to tell Mark about this. He'd want me to let NASA handle it, especially since I'll have to cannibalize for parts. But deep down, maybe I don't want to tell him because he might find a flaw in the plan.

"Triangular?" signaled the Keeper. "That's the sculpture, isn't it?"

"Yes," signaled the Librarian.

Entry 77
Explorer Clock: 02 Aug 2048—04:49
Capsule Clock: 08 Jun 2048—12:27

I've just heard from NASA. They've said all the right words, but what it comes down to is that they'll whip up a rescue mission, but they can't say when. I'm not surprised. I know how NASA works.

There's even worse news; they've calculated that the *Capsule* will sink a good bit further into the gravity well before stopping. They can't predict exactly how much. But it's not going to make my rescue any easier.

So it comes to this: either I get my field diverter circuit built, or I'm stranded here—maybe for years.

Entry 79
Explorer Clock: 3 Sep 2048—5:25
Capsule Clock: 16 Jun 2048—12:36

I've just gotten devastating news from the *Explorer*—although I can't say it was unexpected. NASA says they have to return to Earth. I'm okay since my food and oxygen will last a long while, at least by their time. Time though, is getting to be a tricky concept to keep on top of.

I can't bear to think of the *Gravity Explorer* going back, leaving me alone here. I'll be isolated in space, but in a real sense, isolated in time also.

There is some good news, relatively speaking. They'll detach their antenna array and leave it. That way I'll still have contact with home.

Mark really doesn't want to go. I can hear it in his voice. But then, he has a family too, and he has no choice. He tells me that if it looks as if my provisions are likely to run out, just take the *Time Capsule* a little deeper. That'll give NASA more time to get together the rescue mission.

My Field diverter board is coming along, but at a glacial pace. The work is more like art than engineering. I've had to laser-melt the solder from the backup computer boards so I can reuse it for my diverter. And I'm using first aid tape for insulation. It is tedious beyond measure. I'm racing time. For every hour I work, over four hours go by on Earth. And it'll only get worse. And I can only work on the board for four or five hours at a time before I start making mistakes. I have to take breaks, agonizingly long breaks.

The Keeper paused in his scanning of the cylinder. "He struggles for his technology the way we struggle for our art."

The Librarian pulsed agreement.

Entry 80
Explorer Clock: 03 Sep 2048—15:48
Capsule Clock: 16 Jun 2048—15:01
The *Gravity Explorer* is gone.

Entry 85
Explorer Clock: ERROR
Capsule Clock: 25 Jun 2048—17:18

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I've been watching Earth transmissions, but it is hard. I feel that the half-hour spent watching an occasional sitcom is a waste of time, days and weeks of time. And the news programs are less interesting to me now since I'm losing touch with the context. It's hard keeping up. I feel like I'm drowning, events flashing before my eyes so rapidly, I can't pause for breath.

I saw myself on the news today—moving slowly, as if through molasses. I'm beginning to feel like history.

The engines seem to be working well, thank God. I wish I could move my ship into orbit around the black hole and not have to worry about the engines. But then I'd lose my line of sight with the antennas and wouldn't be able to communicate with home. I couldn't bear that.

Anyway, around a three-hundred-meter horizon-diameter black hole, that orbit would be too fast to be stable.

But above all, it is the diverter board that obsesses me—that little triangular circuit board that is my link to home. When I'm working on it, I can hold off the despair.

"Who is that God, be thanks?" the Keeper signaled.

"I'm not sure, Keeper. Perhaps you should ask a Theon."

"That is what I was afraid of."

Entry 86
Explorer Clock: ERROR
Capsule Clock: 26 Jun 2048—09:00

I look at myself in the mirror and see that I'm ragged and exhausted. It's hard for me to sleep. I don't want to, and when I do succumb to sleep, months pass.

Entry 88
Explorer Clock: ERROR
Capsule Clock: 28 Jun 2048—09:00

Jennifer is getting married.

As my ship sinks into the abyss, Earth-time moves ever more quickly. I've watched as my little girl has grown up: going from Brownies to Girl Scouts, discovering boys, going off to college and now is about to get married. (I'm really happy for you, Jennifer. He seems a nice guy—not much younger than me, actually. At least I don't envy his youth.)

Entry 89
Explorer Clock: ERROR
Capsule Clock: 30 Jun 2048—07:49

I'm afraid my wife has aged badly. I hate myself for it, but I find I'm becoming repulsed by her wrinkled face surrounded by white hair. It feels as if I've married a grandmother. "Grow old along with me." God, I wish I could.

Mark, my twin and soul mate, is becoming an old man.

Needless to say, NASA has not sent out a rescue ship, and I've grown tired of asking them why. Either they don't have the technology or they don't have the money. Even if they did send in a ship, there's not much for me to go back to. My colleagues are dying like flies.

Damn it! When will this diverter board be done?

Entry 90
Explorer Clock: ERROR
Capsule Clock: 01 Jul 2048—09:00

I don't have video communications anymore and have to make do with old-fashioned audio and text transmissions. Not that the news from home is good. My wife has died, and my brother is near death. Jennifer is 64, almost twice my age. She calls me by my first name now, as "Daddy" seems increasingly inappropriate. At my current rate of time flow, she'll die within hours. I don't know if I can take that. I love her dearly, and she's my last connection to Earth.

I've finished the diverter board. Now I've got to wire it into the Richardson Field controller. It's straightforward, but it requires precision. One slip and it's all over.

Entry 92
Explorer Clock: ERROR

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Capsule Clock: 03 Jul 2048—10:26

I'm utterly alone. The Earth link has gone down. I don't know why. I guess after a century or so, the antenna-targeting servos were bound to fail.

Why am I still updating my log? Jennifer's dead. The log was for her. Habit, I guess. Something to do. An attempt to keep my wife and daughter alive in my mind. I don't know.

The diverter board is connected. All I have to do is to turn it on. But, I'm afraid. What if it doesn't work? I'll either die or be left without hope, and I'm not sure which is worse.

I'm staring at the little triangular diverter board—my three-sided salvation. I hope and pray.

I've got to stop temporizing. I'll have a cup of coffee and throw the switch.

Entry 93
Explorer Clock: ERROR
Capsule Clock: 03 Jul 2048—11:31

It didn't work.

"I go dark for him," signaled the Keeper, "even though if it had worked, I assume we'd never have gotten the journal. But still, I grieve."

The Librarian emitted a field of shared empathy.

Entry 95
Explorer Clock: ERROR
Capsule Clock: 05 July 2048—01:16

I've come to grips with the failure of the diverter board. I'm alone but I have humanity's works all around me: ghosts of humanity. I feel like a ghost myself.

Since I've lost contact with Earth, I don't feel as if events are rushing by anymore. I have time—all the time in the world.

I talk to myself and play chess passionately—not against the computer, but against myself. Is this schizophrenia? I wonder if my mind is going. I'd hate that since my mind is all I have left. I find myself humming Bach fugues, using the drone of the engines as counterpoint. The engines are a comfort. They seem alive.

But why after all these thousands of years, has no one come to explore this black hole? Even if they've long forgotten me, what's happened to humanity's drive for exploration? For that matter, what's happened to humanity? I'm plagued by the thought that there may have been another Dark Age from which the Earth has never recovered. Why else would they have given up on the universe?

After all that has happened, I don't know why this troubles me so much, but the constellations have changed. The stars are drifting out of position and the sky that I've watched since I was a small boy is turning alien. Orion, Ursa Major, Cassiopeia . . . I have the urge to reach out and put the stars back where they belong.

At least the Sun will pretty much stay put. The black hole and the Sun are in fact a weak binary system. The black hole will stay in the solar neighborhood indefinitely.

Entry 96
Explorer Clock: ERROR
Capsule Clock: 05 July 2048—13:00

One more isolation—this time from myself. Apparently, the magnetic pulse from the diverter board scrambled the computer's hard drive. The programs are okay; they're on ROM. But my journal has been trashed. I've worked hard to recover as much of my log as possible—committing it to paper this time. I don't know why I feel so attached to this journal, especially as I'm the only one who'll ever read it.

Now I'm printing out hard copy of the entries as I write them. There's a comfort in paper.

Entry 97
Explorer Clock: ERROR
Capsule Clock: 06 July 2048—15:12

The Sun has just gone into its red-giant phase. Its diameter reaches out to

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the Earth's orbit. The Earth is now a charred cinder.

Since there is little else to do, I've been making astronomical observations—measurements of the time rate of change of the Hubble constant. (My little girl is gone, so I can write like an astrophysicist again.) Mark was right. The universe will die the entropy death of expanding into nothingness. Gosh, I'd like to tell him that, but he's been dead for billions of years. I know the answer to the ultimate question of cosmology, but there is no one to tell.

The Keeper quivered in surprise, an electromagnetic aura of excitement radiating from his body. "Billions of years? Are you sure of the time unit?"

"Completely."

"This is wonderful, fantastic, great!" He flowed over to the Librarian. "Do you know what this means?"

The Librarian exuded shared joy. "Yes, Keeper. But I didn't want to spoil the thrill of your discovery."

The Keeper threw excited electromagnetic spikes to the extremities of the lab. "The Theons are wrong," he signaled. He grew dark, then focused on the Librarian. "You must publish the journal immediately. If the Theons are shown wrong that the universe was created one million years ago, then they're totally discredited. We can outgrow this idiotic idea of Artistic Creation."

"Agreed, but . . ." The Librarian emitted a soft aura of tentativeness.

"Not you too, Librarian."

"No, no. Of course not," signaled the Librarian. "But I do wish there were an aesthetically pleasing explanation of the origins of life on our world."

The Keeper's aura clouded. "Yes. It is a vexing question." It brightened. "Now about that journal . . ."

"Yes, of course. I'll beam it directly to the Disseminator. Do you wish to scan the rest of the document before I do?"

The Keeper paused. "No. I'm too excited to scan more at the moment. I'll absorb the rest when it hits the ether." He exuded a contemplative aura, then set the cylinder on a lab table. "Still, I'd like to meet here again tomorrow—at first light plus two, if that is possible for you."

"Yes. Certainly."

Shortly after dawn-major, the Keeper stormed into the lab. The Librarian awaited him.

"The cursed field-dead Theons," the Keeper signaled, choppily. "They claim the journal is a hoax and the craft a clever fabrication. They cite the lack of an alien body as proof."

The Librarian, his aura showing dejection, signaled, "I know. The Theons have always been better at dissemination than we've been."

The Keeper showed agreement. "I'm afraid so. With this claim of fraud, they'll be stronger than ever." He flowed to the lab table and took up the cylinder. "In the frenzy," he signaled, "I didn't manage to finish scanning it."

"There's not much more," signaled the Librarian. "Please feel free to scan it now."

"Thank you."

Entry 98
Explorer Clock: ERROR
Capsule Clock: 07 July 2048—11:22

It's almost funny. I was going over the diverter board. There was a cold solder joint—a damned solder joint. It was an easy fix. Took fifteen minutes.

It still didn't work. When I hooked it up, the board emitted a wild assortment of electromagnetic field signals. All the computer and video monitors go crazy when the diverter is on.

But the tragically funny part is that the diverter diverted me from finding the solution. I worked the math (I can't understand why NASA didn't come up with this) and found that if I used an escape pod, I could maneuver it in front of the *Time Capsule*. The *Capsule*'s Richard-

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son Field should shield the pod. I could simply blast free of the black hole. I can't allow myself to think about it—to dwell on billions of years of what-ifs.

I can escape now, but there's no place to go. Escape is pointless.

Entry 99
Explorer Clock: ERROR
Capsule Clock: 08 July 2048—09:33

It will be quiet soon—like the still of a mountain valley after a gentle snowfall. Very soon now, I'll turn off the engines. After a short while the *Time Capsule* will pick up speed, plunge through the event horizon where time in a sense stops, and then fall to the naked singularity at the center. I wonder how long the Richardson field will protect me from being crushed or pulled apart by tidal forces. Maybe forever—whatever that means.

I feel somewhat better now that I've made a positive decision. Strange, but until now I'd never considered suicide as particularly positive.

I still have enough scientific curiosity left to wonder what it'll be like going through the event horizon. It's a small, vestigial curiosity, though, as I have no one with whom to share the experience. "No man is an island," somebody said, John Donne, I think. I almost want to laugh. How could he have known? How could he have possibly known?

It's funny. As I die, so too will the universe. It will not outlast me. Strangely, that is a comfort.

I feel the need to die with some emblem of humanity—music perhaps. What is appropriate for the death of the universe? Beethoven's Ninth? Schubert's Unfinished Symphony? Well, if it's not finished now, it never will be. I think I'll go with the Ninth.

Entry 100
Explorer Clock: ERROR
Capsule Clock: 08 July 2048—10:00

I've just had breakfast—my last meal. With Beethoven playing in the background, I'm writing this—probably my last entry—probably *the* last entry (100 is a nice round number for the end of time).

All that's left for me is to throw the switch. Then, I can use my telescope and watch the Milky Way die. As for the other galaxies, they'll grow so distant that they'll be beyond the resolving power of my scope. In my mind, I see the stars turning blue from the gravitation field—a lovely, rich shade of blue becoming deeper and fading to invisible ultraviolet.

But then, perhaps Einstein-Rosen bridges do exist and as I go through the black hole, I'll pass through a wormhole and travel back in time. I could come out in physical space, filled with stars and galaxies and warm living souls. And since all NASA spacecraft are fitted with SETI-kits, including this one, I might even be able to communicate with those souls.

This is absurd; I'm kidding myself. The certain outcome is death. Let it be quick.

My family, my friends—they lived their natural lives. It makes no sense for me to grieve for them. I can only grieve for myself—and I refuse to do that any longer.

My hand is on the switch. I'll miss the sound of the engines.

"So, that's it," signaled the Keeper.

"That's it."

"Too bad." The Keeper started for the portal. "It would have been exceptionally helpful if we'd had the body."

The Librarian signaled agreement.

"But how is it I wonder, that we have the craft?"

"I have a theory," flashed the Librarian, displaying extreme modesty.

"Do you?" The Keeper gestured that the Librarian draw closer. "Come. Join me in my studio for sustenance.

"I'm honored. Thank you."

"Afterward, tell me your theory." The Keeper radiated a deep-thought aura.

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"And since you are the principal authority on the alien, perhaps you and I together can find something in the document that would prove the creature's existence."

"No!" Conrad moved his hand away from the switch. "This is not the way for humanity to die." He made a fist and let it fall to the console. "Last one leaving the universe, turn off the lights." He shook his head. "No."

Snapping to his feet, he backed away from the pilot's console. He wasn't sure what changed his mind; maybe his instinct for self-preservation, maybe his longing for home. Earth was no more, of course, but he still could end his days in his own solar system—if he could break free.

He opened the connecting hatch to the left-side escape pod. Feeling pleasure at the thought of leaving the *Capsule*, he grabbed his journal and started through the hatchway. Then, almost out of a sense of whimsy, he pivoted around, pulled free the diverter board from its wiring harness, and took it with him into the pod. Assembling that board had been the work of eons.

After strapping himself in at the pod's pilot's console, he powered up the electronics and turned his attention to the navigation cluster. He paused. There was no Earth to navigate to. But he could auto-locate Saturn. He let out a bark of a chuckle. Titan, in fact, had been the last solar system body he'd set foot on. It was as much home as anywhere. He set in the A.I. navigation parameters for Titan.

Before starting the engines, he ran through a mental checklist. His NASA flight training had taken hold; he had a mission again. Logic suggested that since he had two escape pods, he could set this one on remote-launch and watch from the *Capsule* to see if it worked.

Quickly, he released his harness, and dashed back to the *Capsule*. He whistled. The physical activity had made him feel human again.

In the *Time Capsule*, he took remote control of the pod. Hearing the clank as the pod separated from the *Capsule*, he eased the pod to a position directly over his top viewport. It didn't take much thrust as the pod was well within the *Capsule*'s Richardson field. Gritting his teeth, wondering if the viewport would stand up to the blast from the pod, Conrad threw the pod control to auto-navigate. He held his breath as he pushed the launch button.

The pod moved slowly at first, then rapidly gathered speed. Conrad whistled in astonishment at how fast the pod accelerated. Then he realized that it was a gravity effect; the pod's clock was speeding up as it escaped the black hole. The pod would reach Titan many months before he could possibly arrive in the other escape vehicle. But the point was—it worked. He had a ticket home. He smiled. *Odd, thinking of Titan as home.*

Conrad stretched, then scrambled into the remaining pod. He reprised his actions on the first pod, then hit the control separating the vehicle from the *Capsule*. His craft, buffeted by the turbulence from the *Capsule*'s engines, shook like a bicycle on a railroad track. He maneuvered the pod to sit over the *Capsule* and the vibrations ceased. Conrad took a deep breath, slowly blew it out, and then levered the thrust control to full. The engine roared, the craft trembled, and the acceleration forced Conrad deep into his seat. It took a long hour, but the pod broke free of the black hole. Conrad moved his hand to pull back on the thrust control, but then changed his mind. Having no reason for caution, he ran full-speed toward Saturn. This time, relativity would work *for* him. With the Richardson engines, he could travel at near light speed and reach Titan in almost no time at all.

He slapped a hand against the control panel. *Damn it. I left the journal in the other pod.* He shook his head. *As if it*

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matters.

Three hours later, as measured by the pod's elapsed time meter, he reached the Oort cloud, the nominal boundary of the Solar System. He slowed his engines, and then slowed them further as he came into Saturn's neighborhood. Through the forward viewport, the Sun loomed large and Saturn gleamed with magnificent intensity under the red-orange light. Although the Sun was now a low-luminosity star, it was huge and, relatively speaking, close. As he watched, the auto-navigation system directed the pod toward Titan.

Shifting his attention from the viewport to the computer screen, he pulled up a manual navigation display and eased the pod into a close orbit around the great satellite. After a moment of relaxation, reveling in the sensation of weightlessness, he switched the monitor to the pod's forward camera.

He jerked forward against his harness, staring open-mouthed at the monitor. Unlatching his constraints, he push-floated to the viewport and gazed out. He had trouble believing what he saw; Titan looked like Earth—oceans, green continents, fluffy cloud cover. But the spectrum was shifted toward the red—Earth through rose-colored glasses. *This is impossible!*

Then he remembered reading a paper theorizing that in eight or so billion years, the Sun in its red-giant phase would heat Titan to the point where the temperatures would be in the habitable zone. Conrad smiled. It was great seeing a validation of theory.

In a fit of scientific curiosity tinged with hope, he pushed back to his console and made some measurements.

He ran a spectrographic analysis of the atmosphere and surface, and then ran them again before allowing himself to believe the results; the air was actually breathable, the atmospheric pressure like Earth's at sea level, and the oceans composed of water—a far cry from when he'd been here last: 95 percent nitrogen atmosphere at sixty times Earth's pressure, surface temperature of -175 C.

He returned to the viewport, this time merely to drink in the beauty of nature. Saturn's disk subtended an angle of about five degrees—about ten times that of the moon as seen from Earth. And the Sun, at about fifteen degrees of arc, appeared thirty times larger. But with its lower luminosity, Conrad could gaze on it without hurting his eyes. *Simply beautiful!*

Conrad returned to his seat and fastened his harness. His destiny, brief though it might be, lay on Titan. In preparation for landing, he switched the monitor to the down-looking camera and cranked up the magnification. He needed flat terrain to set down safely.

"What?" Conrad felt as if he'd been struck. Straining forward in the harness, he peered at the monitor, trying to see deep but being limited by pixels. There was no doubt; structures, artificial structures, were slowly drifting across the screen. The regularity and complexity of the view suggested a medium-sized Earth city. Conrad let out a breath he didn't know he was holding. There was life on Titan, intelligent life. He shook his head in wonderment.

When the shock had subsided and the "city" had drifted out of view, Conrad tried to think it through. The obvious answer was that people of Earth had migrated to Titan before the Sun went red giant. But as he considered it further, that seemed astronomically improbable; at that point, Titan would still have been a dark, frozen, uninhabitable world. And anyway, he'd been monitoring Earth and had seen it go dead.

As for colonists from another star system, that too seemed a stretch; he would have likely seen the traffic and the voyagers would surely have explored his black hole.

Conrad shrugged. *Life must have just evolved naturally on Titan.* He narrowed his eyes, realizing that evolution was an even less likely solution than

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were his other ideas. The Sun's red-giant stage could not possibly have lasted for more than about seven hundred million years. There was not enough time for a high order of life to evolve—not from a cold start at any rate. And his expedition had found no trace of life whatsoever on Titan, not even any complex organic molecules.

Thinking about his Titan expedition, it suddenly hit him. Evolution spends most of its time in the microphase—the development of microbes and single-cell organisms. If Titan had been seeded with those microorganisms, then there would have been time for intelligent life to evolve.

Conrad laughed, a sound grown unfamiliar to his ears. It had to be the waste canisters from the expedition. When the satellite warmed up after those billions of years, the canisters decayed, spilling microbe-rich human waste onto the surface.

Humming softly, Conrad seized the controls and began his descent to the surface. He smiled. He could drink the water, at least after boiling it. And since Titan's life was derivative of Earth's, if his luck held, he might even find food; his destiny might not be as brief as he'd expected. And it would certainly not be boring.

In his eagerness to go forth and meet his descendants, Conrad had to force himself not to rush the landing. He could scarcely bear to waste even a minute. ■

IN TIMES TO COME

Our November issue leads off with "Imperfect Gods," a new novelette in C. Sanford Lowe and G. David Nordley's series about a research project so big that it won't fit in one story—or even one solar system, or one century. "Kremer's Limit," in our July/August issue, was set relatively close to home; "Imperfect Gods" takes place in a colony around Groombridge 34A (almost twelve light-years away), on a planet called New Antarctica—at story time the most Earthlike extrasolar planet but, as the name suggests, still quite different. And if you think cooperation over such times and distances is easy . . .

We'll also have a very different novelette by Grey Rollins, and a potpourri of stories by such writers as Wil McCarthy, Jerry Oltion, and Catherine H. Shaffer, including a little something for the season. "Floatworlds," the science fact article by Stephen L. Gillett, Ph.D., looks at a type of world familiar in science fiction, and where such places might actually exist and what they might be like.

And, of course, we'll have Part III of Robert J. Sawyer's four-part novel *Rollback*.

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THANKSGIVING MUSINGS

It's Thanksgiving time here in the States, and one thing I'm thankful for is, as one might expect, my children. Haley, Ashley, and Joshua are all good kids. What I often find most interesting about them, despite how self-absorbed this sounds, are those parts of *me* that I see residing within them.

Haley definitely favors Dorothy in looks and stature, my half-Japanese wife being on the short side. Though remarkably precocious intellectually as a baby, Haley seems destined to be a jock. There's nothing wrong with that, but sometimes I think the only thing she inherited from me is poor penmanship. Ashley favors my side of the family in looks, and was taller than her mom by age nine. If I were to pick one of my kids who is most likely to pursue a literary career, she's the one. She also shares my interest in science and nature, and is the most likely of the three to bury herself in a book and get cranky when interrupted. She wanted both a microscope and a telescope for Christmas and she got them. She invents robotic alligators out of Tinkertoys and dreams of one day finding Narnia for real.

My son Joshua is the youngest, and has personality traits in common with both of his sisters. Though my girls were tomboys, when Joshua came along, Dorothy and I saw the difference between little girls who act like little boys, and an actual boy. Though the girls played with their share of toy cars, Joshua was our first child to take a picture of a car from a magazine and make motor noises as he raced it along the wall. His sisters share his interest in making things, but they are not at all as fond of breaking them. Only my son exhibits, as did I, that typical behavior of the mechanically inclined child—deliberately taking or breaking things apart just to see what's inside or how they work. More than that, he's the only one that likes to exhibit a thing with springs and gears, or chunks of circuit boards with stray wires and colorful capacitors, as an *objet d'art*.

With age comes maturity, or at least the requirement to keep up the appearance, so I, of course, no longer tear things apart just to scope out their insides. Okay, that's a lie. Actually, I don't hesitate to help Joshua take things apart if he can't quite manage it on his own. And I still do it for myself, only now I claim that I'm "harvesting parts." Sometimes I even keep those parts, if for no other reason than that they are pleasing to the technological eye.

However, taking things apart to see how they work just isn't as fun as it used to be. I don't think it's because I'm older—the problem is that technology isn't as transparent as it used to be. Sure, you can still disassemble a simple wind-up watch and figure out what the gears do and how the spring mechanism drives the gizmo. But you can't learn a whole heck of a lot when you open up an electronic watch unless you already know quite a bit about them to begin with.

The same goes for a TV or even a simple AM radio. Take the back off the radio and at best you only see a few wires. Most everything is on a circuit board, and some of the components are literally black boxes looking more like a Cubist's idea of a spider than anything having to do with electricity!

I miss those days when technology was transparent to the mechanically inclined

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boy or girl. I only caught the extreme tail end of that period, and only benefited from it as much as I did because my father (about whom you can read in my June 2006 Alternate View, "My Mysterious Father") knew how to do everything and I could watch him.

Perhaps that's also why Golden Age science fiction sings to me with such a sweeter voice than most of the more recent stuff. I don't think it is just because I was reading Asimov, Heinlein, and Clarke when I was 12 and thus connect those stories to my own youth. I think it's because those writers grew up in an era when most technology was accessible to the educated layman in a way that most of it now is only accessible to those with a technical education.

There is a good description of that era in the author's preface to *Electrostatics* by A. D. Moore (1), which is essentially a how-to book on build-it-yourself electrostatic machines. Born in 1895, Moore grew up in Pennsylvania, and had this to say about his formative years on page 15:

"I was raised on a farm, where there are many problems to be solved and many handy things to be learned. And when painters or roofers or carpenters or plumbers or threshers would come, endless questions could be asked—and I surely asked them . . . But when loose from farm chores, I spent lots of time in the plumbing shop, the hardware store, the blacksmith shop, the foundry, the machine shop, the brickyard, the lumber mill and the glass plant. There were the coal mines to visit, and the coke ovens. There was a power plant, where the engineer was my friend. There was the streetcar line, where the motorman was my friend. There was the telephone man, who came to put new dry cells in our telephone, and he would give me the old ones to use in my experiments. It was a very rich environment for a kid who wanted to be an electrical engineer. . . ."

Moore's experiences were hardly unique for engineers who came of age in the early decades of the twentieth century. But he then contrasts his era with ours:

"Coming back to you: today, safety rules prevail, and you, to my great regret, cannot wander at will in a glass plant or other factory. 'KEEP OUT' is a familiar sign. This denial of free access to American industry is a great loss to a full childhood, and believe me, a great loss to science and engineering."

And I can only agree. Clarke's observation about sufficiently advanced technologies being indistinguishable from magic has applied in our own era at least since the advent of VCRs unprogrammable by most owners. True, we know we aren't *really* dealing with magic, but the practical result is often that we might just as well be. Going to the shaman or going to the IT guru, both do tricks that look like magic.

What's a body to do?

Even though the thirst remains to take things apart with my hands, I've found a substitute to slake that thirst, and that brings me to something else I'm thankful for, Lindsay's Technical Books (2). I found out about Lindsay when reading the little three-line classified ads in the back of a *Popular Mechanics* in the barbershop maybe 15 years ago. Lindsay offers exactly the kinds of books a guy like Moore would like to see in every library, often reprinting books from a long lost era. For instance, one of my recent purchases was a reprint of the *1935 Shortwave Radio Manual,* edited by Hugo Gernsback and H. Winfield Secor. Gernsback is none other than the man after whom the Hugo award is named.

In that Alternate View about my dad, I talked about how he used to have his own radio and TV repair business. Once for fun he decided to make a four-tube radio receiver straight from the schematics, only he laid it out to physically reflect pretty much exactly the way the schematics depicted the circuitry. He built a wooden base and the tubes were inserted upside down so that the connections to the sockets would be visible. For the common chassis ground he used a buss bar of thick

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copper wire. All of the wiring was straight, just like the lines depicting wires in the diagram.

Unfortunately, at the time I was too young to appreciate that radio, and I have no idea what ever became of it. But the memory stuck in my mind and I used to think how cool it would be to go one step farther, and actually build a tube radio with homemade tubes. That is, to actually make the cathode and anode and grids of a vacuum tube by hand, then enclose the unit inside a bell jar and pump out the air.

I never actually did it (well, haven't *yet* done it), but someone else has, and surprised and delighted I was when the (then) latest Lindsay's Technical Books catalog arrived featuring *Instruments of Amplification* by Peter Friedrichs. There's a picture from the book right there in the catalog showing exactly what I'd had in mind—you can see the cylindrical anode with a wire-spiral grid and a cathode inside that, all enclosed in a spherical glass bottle. According to Friedrichs, these model tubes give performance comparable to the earliest vacuum tubes. If you're at all like me, your fingertips are already tingling in anticipation of making one of these yourself.

For those who want to emulate Moore in this day and age, I really know of no better place to start than the Lindsay's Technical Books catalog. If you don't have your own machine shop, Lindsay has books that will show you how to make your own. I mean that literally—books are offered that will show you how to make a metal lathe, milling machine, drill press, sheet metal brake, and others, and all from scrap materials. A few additional titles will give you the flavor of the offerings: *Build a Two Cylinder Stirling Cycle Engine*; *Automobiles 1913-15*; *Steam Engine Projects*; *Manufacture of Bricks and Tiles*; *Electrical Things Boys Like to Make*; *Secrets of Building An Alcohol Producing Still*; *Building Small Barns, Sheds, and Shelters*; *Mechanical Devices for the Electronics Experimenter*; *Metal Spinning*; *How to Build a Forge*; *Procedures in Experimental Physics*; and incredibly, *Saturn: The Complete Manufacturing and Test Records*, perfect for anyone who wants to take a Saturn V Moon rocket apart to see how it works, but doesn't happen to have one at hand.

Even though I've been getting Lindsay Book Catalogs for years, I'm still amused by the unusual and humorous nature of some of the offerings, like the *I Just Love to Fart Cookbook*, which contains recipes to enhance the flatulence in your life. There is also *Gems of American Architecture*, a mock-catalog featuring 22 different "brands" of outhouses from their final golden age during the Great Depression. And if you're into siege engines, there's *The Art of the Catapult* by William Gurstelle, in which you will learn about catapults, both their physics and their history, and how to construct your own working models.

A. D. Moore finished that last paragraph I quoted about our era with this thought:

"What can you do to help make up for it? You can steam ahead on your own, as an experimenter, learning about materials and processes and functions, having your own failures and successes, acquiring common sense and judgment as to what will work and what won't. There is just no substitute for acquiring this kind of know-how.

"If this book does nothing more than coax you into experimentation with electrostatics—or anything else!—it will have served a good purpose."

And that goes for this column, too.

References

1) *Electrostatics* by A. D. Moore. ISBN 1-885540-04-3. You can find it at www.electrostatic.com.

2) You can request the latest Lindsay's Technical Books catalog at www.lindsaybks.com, or by writing to Lindsay Publications Inc., P.O. Box 538, Bradley, IL 60915-0538. (Catalogs are free in the U.S. and Canada, $4.00 US for the rest of the planet.) ■

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The crackling conclusion to Marc Giller's two-part adventure

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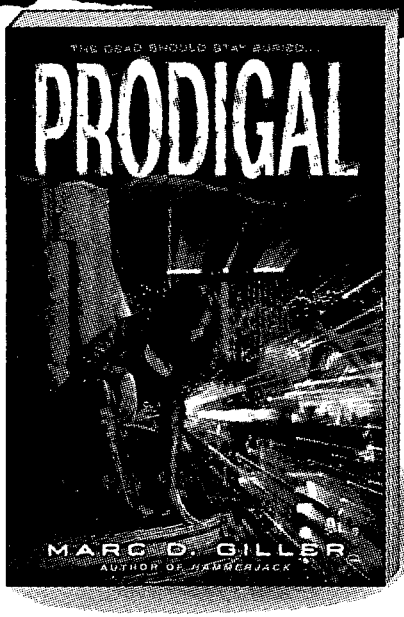

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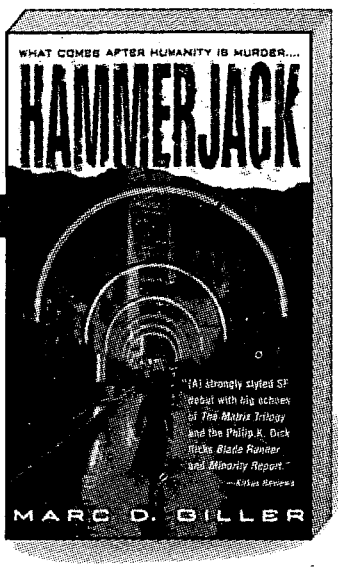
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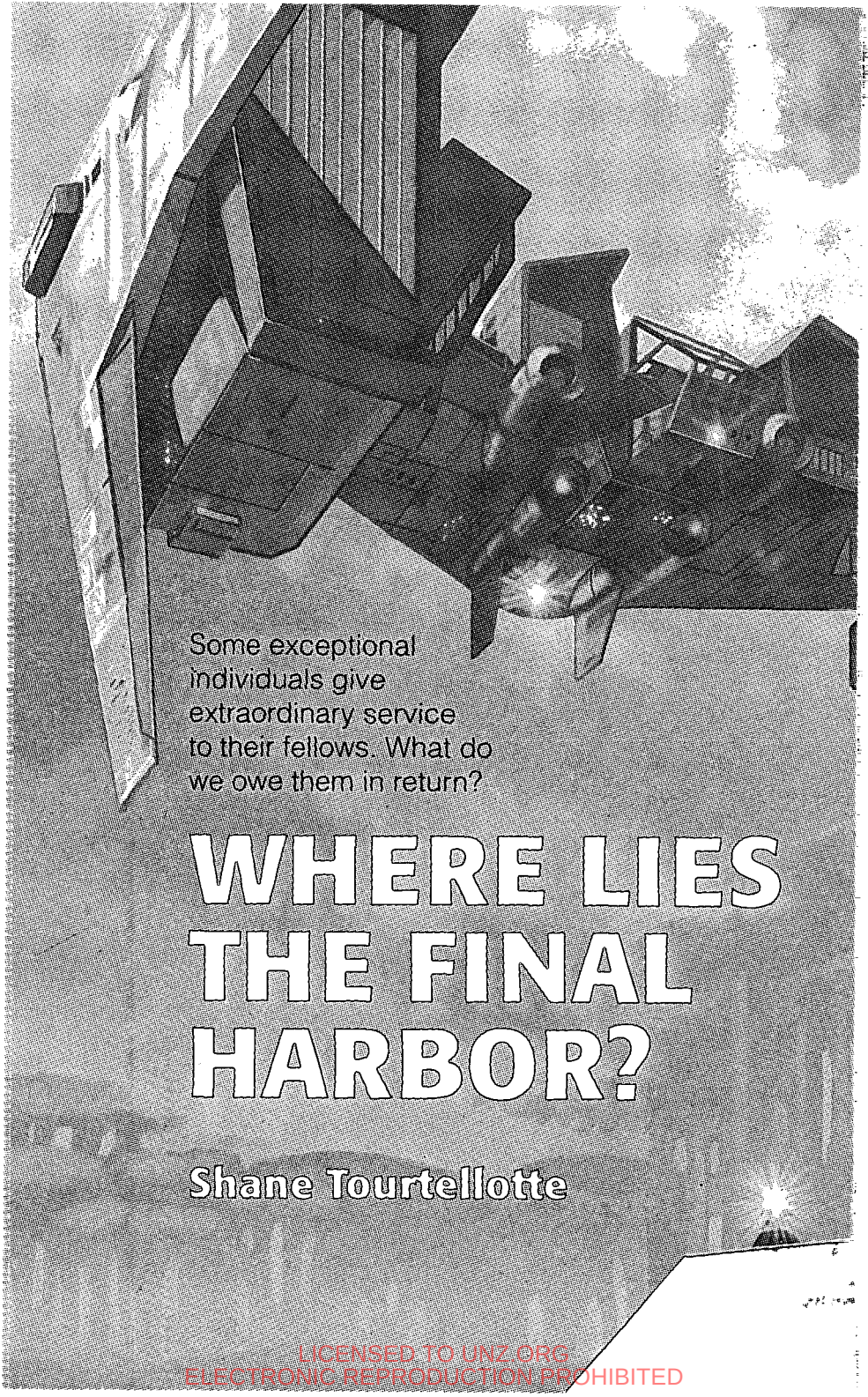

Some exceptional individuals give extraordinary service to their fellows. What do we owe them in return?

WHERE LIES THE FINAL HARBOR?

Shane Tourtellotte

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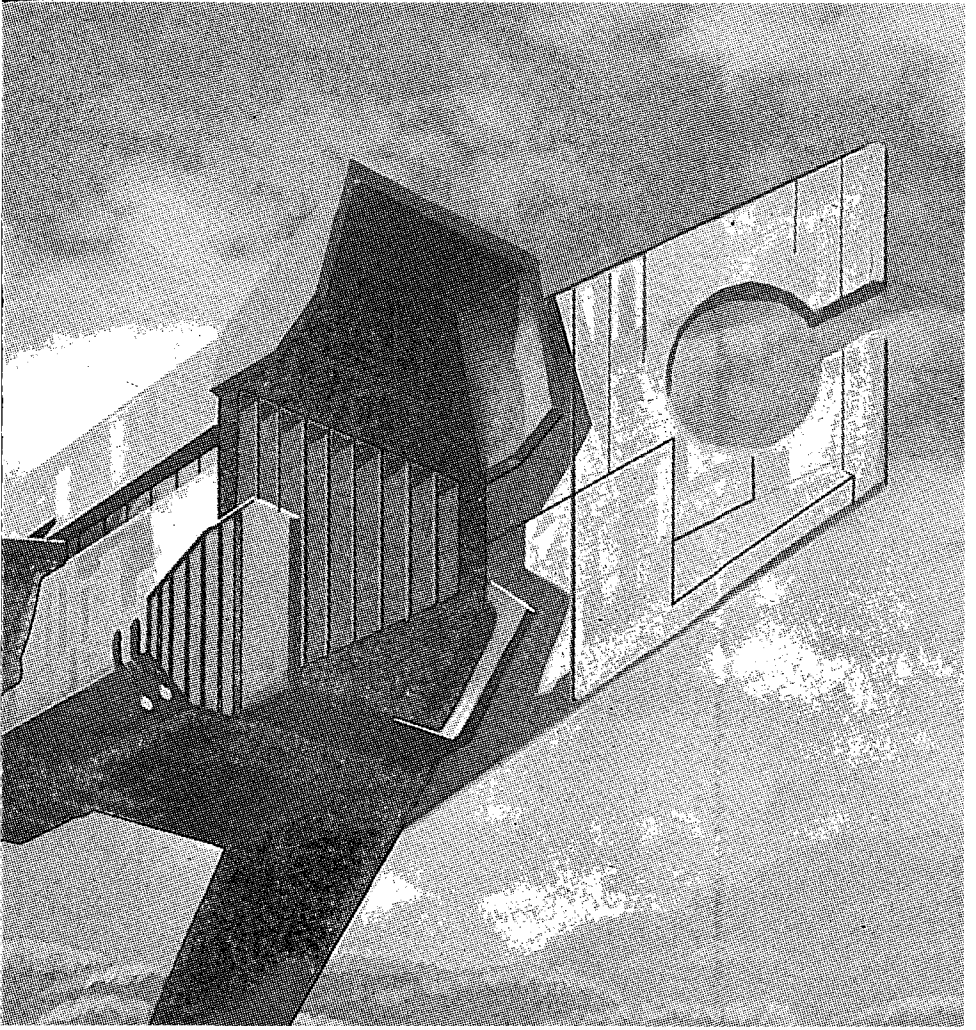

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"Where have all the navigators been going?"

The young man set down his drink as peripheral talk in the station lounge crested, then receded. "If you think I can answer that question, it's going to be a short interview."

Chloe Roberts leaned in just a bit, a honed technique for her. "As a navigator yourself, don't you wonder sometimes? Don't you worry?"

Pascal Mesereau's face grew solemn. It looked natural for him, the direction in which his still-boyish face was evolving. "I have my duties to worry about, Ms. Roberts. That's enough to occupy anyone."

That was a standard sentiment among navigators. Their links with ships' computers, crucial for faster-than-light travel, were draining experiences. How draining they were, the navigators alone knew. Chloe was enough of a professional skeptic, though, to see what they could gain from overstating the matter.

"Well, other people are noticing the trend, and it worries them. FTL navigators are a critical, um, component of modern society."

"You were about to say 'commodity,'" Pascal observed.

"No. I don't think that." Was she about to lose him?

"When there's a limited supply, that's how people start thinking." His face shifted. "I guess if you hear other people say it enough, you can start thinking it, even if you don't believe it."

Chloe sighed inside. If Pascal was making excuses for her, she had him on the hook. As usual, her natural charms were making her reporting work easier.

"But your rarity is all the more reason that people worry," she said. "We can't afford to lose navigators, but very quietly, almost secretly, we are. They just vanish from one port or another—no pun intended—and by the time anyone reports them missing, it's hopeless to try to track them down."

Pascal sipped his drink. "It's not something I've ever heard other navigators discussing. Maybe it's a taboo—we've got some—but there's just no talk."

That didn't surprise Chloe. The few navigators she'd spoken to since arriving in the Zeta Reticuli B system, and most of them back at Chi Ceti, had been tight-lipped about the disappearances, and everything else. She'd thought they were excluding a nosy outsider, whatever fame she might carry. Perhaps they were that way even with themselves. That was why this young fellow was so promising, so far.

"What about the navigators who die in transit, and get buried in space or on some remote corner of a colony planet by their colleagues? A few people think that's a cover-up of something."

Pascal shrugged. "I can't help what people think. If that's how navigators want to be treated after they die, well, we're a tight-knit group. We'll look after our own, to the very end."

"I understand," Chloe said. "I wouldn't deny anyone that respect. Still, that kind of thing seems to happen a little too often." She passed him a complate. "Take a look at those numbers." He read the plate with some interest.

"It's happening more and more often," she said. "The disappearances go back decades. I think they go all the way back to Prahlad Shastri."

Pascal nearly dropped the complate. "That Shastri? *This* Shastri?" he said, waving a hand to encompass all of the Shastri Orbital Station, where they and thousands of others were at that moment. Chloe nodded. "I . . . well, I knew he had gone missing, but he was an explorer. That's always been dangerous, especially so thirty-seven, thirty-eight years ago." He passed back the complate. "I think you're on the wrong track."

"I have reason to believe I'm not." Chloe had lowered her voice, and Pascal involuntarily shifted closer to her to hear. "Isn't there anything you've ever

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heard about these things?"

"I don't know. I . . ." As he stammered, Chloe pulled closer, receptive, hanging on his words. "Navigators really revere Shastri," he said, almost whispering. "There are others who charted more systems, more distant ones. There are others who disappeared. But he's the icon, especially among the older navigators. I don't see how that fits in your puzzle, but—"

"Mesereau!"

A fiftyish, dark-hued woman was walking over. Chloe had questioned her yesterday, with zero success. She didn't even know her name.

"We thought it was her," the woman said. "She's been pestering navigators the past two days. Come on back to the Quarter."

"I beg your pardon—" Chloe started to object.

"She wasn't pestering me," Pascal said. "She had a few questions, and I—"

"You've just been navigating three days solid. You haven't even had time to sleep since you came aboard Shastri."

"I had a few hours before docking. I'm okay, Thalia. Maybe a little peaked."

"I can reserve you a room—"

Thalia skewered Chloe with a glare. "He has a room in the Navigator's Quarter." She turned a more motherly look to her fellow navigator. "Pascal."

Pascal wavered. "Ms. Roberts, maybe we should continue this another time."

Chloe knew when she was licked, for the moment. "I'll be here a while longer, Pascal. Call me anytime." He nodded.

Thalia gave her a scornful, up-and-down parting look, then led Pascal away. "Just what kind of proposals was she making?" Chloe heard her ask Pascal as they wended through the crowd. Chloe was too mad to blush.

She staked out the lounge and other public areas for much of the afternoon and evening, but no more navigators appeared. They kept to their specially assigned quarter, the one most sizable stations had. Word had probably gone out to avoid her, same as at Bluford Station back at Chi Ceti V. She couldn't enter the Quarter herself, of course.

She returned to her room after an unsatisfying dinner. There wouldn't be another ship arriving at Shastri for two days, so no more navigators to buttonhole for a while. Unless one of her feelers paid off, she would make no more progress tonight or tomorrow. And maybe not after that.

Just as she was dressed for bed, her handbag chimed. She raced over to pull out her palmphone. "Hello?" There was only the faint pop of a disconnected link, then the standby tone.

Chloe smiled, went to the door, and drew it open a decimeter. A short translucent rod rested on the floor just outside. She snatched it and shut the door. Her contact in the computer center had come through. He had refused attribution, fearing for his job, but he had delivered, and that was enough for Chloe.

Her travel comp was on a table near one wall. She slipped the rod into one of its dataports and spoke her instructions. "Data analysis. Same parameters as Bluford Station data. Don't wake me when you're done. I'll review everything in the morning."

She managed to sleep well, without being tempted to check her computer's progress. Once she first opened her eyes in the morning, though, there was no comfortable drifting back into slumber. She took the comp into the bathroom and had it read out its results as she showered.

The rumors were right, again. Plenty of navigators had been here, departed, and never made system-fall again. There was the same pattern of increasing rate of disappearance, a building phenomenon. Added to the numbers from Chi Ceti, it was now definitely rising as a percentage of active navigators.

And that was if these were the main two points of disappearance, as those

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few spreading the tales back on Earth had suggested. If there were other loci for the trend, this secret wouldn't keep much longer, as the disappearances would soon be too common to miss.

The ages of the vanishing navigators still averaged quite high, with a slight downward trend the last decade or so. If it was some navigation-related malady, as she suspected, this augured ill. Whatever chronic effects FTL navigating had, they were finishing people off younger.

Chloe shut off the water and reached for a towel. Her computer was now reciting its findings on the courses of ships where navigators died in transit. This part wasn't adding up. She stepped out of the stall and listened closer.

To and from Chi Ceti, the bulk of those courses had passed in the general direction of Zeta Reticuli. Here at Zeta R, though, the courses weren't leading anywhere near Chi Ceti. They weren't centering on any major colony or hub, just a diffuse collection of secondary ports.

"Project a starchart," she ordered. "Show the tracks of relevant transits to and from Zeta Reticuli B."

A constellation appeared in the air, with a spray of fine lines erupting from the pair of bright dots that were the Zeta Reticuli suns. Chloe found it little help. "Add tracks of similar transits from Chi Ceti."

Lines sprouted from that star. The main bunch passed several light years to one side of Zeta Reticuli—and intersected the densest part of the tracks coming from that system.

Chloe stared at that juncture. Her original hypothesis dissolved in the interference light of those crossing tracks. What was rising in its place was inchoate, but compelling. She had learned from past assignments to trust this instinct: it had never betrayed her. She had also learned not to hesitate when a lead like this appeared.

She had the computer reel off a few system names, which she committed to a complate and memory. She got dressed, packed up her computer, then packed up everything else in her room.

At the room's Net station, she called up the charter docks and looked over the small ships they had available. Finding the best bargain she could on something with a good sensor suite, she toted up the numbers for the lease fee, deposit, fuel for sixty light years of travel, and stocks for a month. It wouldn't break her corporate account, but it would leave her margin thin. She didn't hesitate.

With the ship's service number in hand, she called up the navigators' roster. Every navigator on the station who was available for hire was listed here. Many worked independently, so she'd have no trouble finding one, assuming they wanted to be available to her.

If she was lucky, though—there! Pascal Mesereau. She pulled up his info box. She had been right about him being young: twenty-six, two years younger than she was. Even so, he had five years of experience as a navigator. She could trust him, professionally.

She entered her request, giving the service number and docking bay of the ship for confirmation and a deposit on his fee. That done, she checked out of her room and settled the bill, then walked out, luggage in tow, toward the docking bays.

Pascal passed through the inner hatch, not moving his eyes off Chloe. "It really was you," he said. "If this is a ruse to get some quiet interview, Ms. Roberts, I'm afraid I'd have to report it to the Commission."

"It's no ruse, Pascal. It's a lead. I need to take a look at a few systems."

Pascal still looked guarded. "Okay, which systems?"

She handed him a complate. "Those four."

He looked it over. "But there's nothing there."

"Nothing we know about." She waited for a reaction. "Are you willing to

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sign on now, or do I need to fill you in all the way?"

"It's not just what I know. It's . . . I'm not sure anyone's done these routes before." He looked up, his face unsettled. "You do know that it's tougher to navigate an uncharted route, right?"

"More dangerous?"

"Some. It's also harder on . . ." He composed himself. "It's easier on a navigator when he has records from other ships, to get a feel for the texture of underspace along that course. New territory requires greater concentration, greater . . . exertion."

Chloe nodded slowly. "Are you not up to it?"

Her needle went home. "No, I'm capable. I'm rested enough. Just finished a good fourteen hours of sleep."

Chloe hid some mild surprise. "Okay, you're ready and able. Are you willing?" She didn't wait for Pascal's hesitation to stretch. "I can go to the others. They may not like me, but someone will like the fee."

After another moment, Pascal stepped toward her, handing her the complate. Chloe thought he was refusing, but then he stepped past her. "Let me check something on the bridge first."

She followed him through the hatch. He took the pilot's seat, situated next to the navigator's port, and started downloading records from the station mainframe. "Yes," he said, "there has."

"Has what?"

He pointed to the display. "There's been a trip from this system to one of the ones on your list. The closest, it turns out: Zeta Doradus. It was a secondary exploratory survey, twenty-five years ago, after—" He laughed. "The first survey was done by Prahlad Shastri."

"I'll take that as an omen," Chloe said.

"So will I. At least one leg of our trip should be a little easier."

"Our trip? Is that a commitment?"

"I suppose it is." Pascal cleared the display. "Have you engaged a pilot yet?"

"I don't need to."

Pascal turned the seat around hard. "See here. I don't care how small the ship is, it needs a slower-than-light pilot. I can do it in emergencies, but—"

"Pascal, Pascal." Chloe handed him a badge from one of her pockets. "I'm certified on small craft. It's really helpful in my work."

He examined the badge and its information screen. "You've never piloted outside the Solar System?"

"Not yet, but I haven't just been doing Earth-Luna shuttles. Should I tell you how I got mixed up with the Kuiper Revolt four years back?"

He handed back the badge. "I remember those accounts. It's how I recognized you yesterday."

Chloe smiled modestly. "Thank you."

Pascal turned back to the console. "Okay, let's get me officially signed on."

"Pascal, it's time."

Chloe heard no response over the intercom. She had been alone on the bridge for hours, during the undocking, pulling away from Shastri Station, and making a vector for Zeta Doradus. Now that they had headway and were out of the traffic lanes, she needed Pascal.

He had closeted himself in his cabin, to get some last rest before starting his duties. Wasn't fourteen hours enough? Chloe had resisted asking that question. She wanted no acrimony with someone who'd be sharing tight quarters for weeks.

Soon, Pascal walked through the hatch. He approached the navigator's port hesitantly, like a child going to the dentist.

The port was a large support chair, enclosed up to chest level. Above it hung a burnished hemisphere studded inside with thousands of thin filaments. Those filaments would be the link between his brain and the ship's computer.

It used to be that navigators had direct physical links, through jackports

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surgically implanted in their heads. Technical advances now allowed for an interface less invasive, more elegant in design. It had lifted some of the physical and mental burden from navigators. Only navigators could say how much.

Pascal opened the side entrance to the port: the name had outlived the jackport years. The opening faced Chloe. "Um . . . could you give me a second, to get settled in?"

Since navigators couldn't leave their stations while in underspace, the port chairs had to handle all human biological needs. It seemed strange to Chloe for him to be modest about this, after five years. Still, she turned her body and averted her eyes.

Finally, there was the snick of the port closing up. She saw Pascal ensconced, lowering the inductance helmet toward his head. He winced at the myriad pinpricks on his scalp. The helmet fastened itself automatically, molding itself to his head. His face showed relief, but not relaxation.

"All right, I'm in contact." His voice sounded tighter, as though his chest were squeezed. "Course is set. FTL engines powered. Transition in ten seconds . . . five . . . and now." The starfield turned to a swirl of gray, slowly flowing past the viewscreen like turbid waters.

Pascal made a sound deep in his throat, midway between a groan and a sigh. "We're underway, Ms. Roberts," he said. "If you want to go to your cabin, you're free now."

Chloe looked his way, casually, as if his situation were nothing odd. "Hoping to be rid of me that soon, Pascal?"

"Uhh, no, but if you have your own—"

"I have my own post-transition checklist. That'll keep me here a while." She started on it. "After that, I can still keep you company." She gave him another look. "And you really should start calling me Chloe."

Small ships, with small FTL engines, were invariably slow. This one would need three days to travel the ten light years to Zeta Doradus. Chloe needed the time to establish herself on Pascal's good side.

He might be resentful of her, feeling pressed so soon after one assignment into another one he knew little about. Fortunately, she had a gift for dealing with people in delicate situations: coaxing out information, talking her way into sheltered areas, and a few times convincing people not to arrest, abduct, or kill her.

Chloe probed a little into Pascal's background, letting him tell what he wanted. She learned fast when to give him a break. Sometimes it was those matters he had been shy about when first entering his port in her presence. Sometimes it was the drain of conversing and navigating at the same time. That drain only increased.

The second morning, she walked into the cockpit with a chipper greeting. "Occupied, Ms. Roberts," he said dully.

"All right." She sat down, and only then saw his face. He was blank of expression, almost a zombie in his port, a nightmare vision of what became of navigators. "Are you okay?"

Pascal's eye twitched her way. "Sleeping. After a fashion. Another twenty-seven minutes, eight seconds."

Chloe had heard of this. The port induced a few hours of sleep separately in each hemisphere of the brain. Half his mind navigated underspace, while the other half got enough rest to keep functioning. She said no more, and sat still in the pilot's chair, waiting.

Some time later, light returned to his eyes. He let his head roll over to look at her. "Good morning, Chloe," he said, then rolled his head back and called up a drink from his port's dispenser. Chloe waited for him to take a longer look, but he never did.

It wasn't that her outfit that morning was outrageous: it never was. She had taken care, though, to make it appealing, with soft colors and silky fabrics. It

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always helped with men, that and showing interest in what they said. Pascal had shown mild interest back at Shastri Station. Now, though, he had bigger things occupying him.

Chloe didn't let it bother her. She kept up pleasant conversation, recounting incidents from the Hartford clone bank story and the Quaoar peace talks when he seemed interested. Sometimes, though, she would alter her pose a little, shift her leg just so. Pascal never took notice.

It was late that afternoon when Pascal finally asked the question Chloe had been awaiting. "Do you know what you're going to find on this chase?" he said. "Of course, if you aren't sure of the system, how sure could you be of what might be there?"

"I'm not sure," Chloe admitted. "My earliest working theory was that navigators were dying of some link-related malady, and it was being covered up. But that wouldn't require getting so many of the vanishing navigators to pass close to a particular patch of space. They're gathering somewhere, or being gathered."

"Oh." Pascal's face looked like it did during pseudo-sleep. "Gathering for what?"

"I can only speculate. Maybe they're being conscripted into some secret military force, a fleet of FTL warships being mustered for an attack on . . . who knows?"

"But you said this began decades ago. The first navigators they took would be dead or decrepit today. Doesn't make much sense, even for the military."

Chloe didn't take Pascal's bait. "It could also be a secret exploratory corps, but it's difficult to imagine what they could be exploring that would need such secrecy. Except, maybe, aliens."

Pascal gave a drawn-out "Oh," and smiled. "That's a secret I can see the authorities trying hard to keep. Worries about culture shock, unauthorized contacts, even belligerent acts. But they'd maintain limited contacts, and skim away some navigators to make the runs to and from alien space. That makes sense."

Chloe nodded. "And they'd take older navigators because it'd be easier for outsiders to believe they had died natural deaths."

"What's this?" said Pascal. Chloe explained the statistics to him. "No, that doesn't add up. Older, more experienced navigators have the highest profiles among us. We'd be losing our best people—we *are* losing them—so we'd notice."

He sank back into his chair. "So why haven't we made a bigger fuss?" he said. "Do we know what's happening, why it's happening? I sure don't."

"Perhaps you don't qualify as needing to know. Not experienced enough, for one thing."

"Oh. Still, it doesn't really tally. Why wouldn't they take some younger navigators, just as they're coming in? They'd get much longer service from them."

"Maybe they are," Chloe said, "and I haven't found that piece of the pattern."

Pascal fell into a study. Chloe waited for him to share whatever he was thinking. In time, she realized he wasn't pondering their theories, but navigating some difficult stretch of underspace. He didn't come out of it for almost an hour, by which time he was pale and needed a ration of water much more than a chat.

He never resumed that discussion. He was losing interest in all conversation, turning inward by visible degrees. Chloe kept up her side, but as his answers and his attention grew shorter, she soon accepted the inevitable.

Still, she wore another eye-catching outfit the next day, for whatever submerged part of him might appreciate it.

"Transition . . . now." The gray churn on the viewscreen went black, and the stars came out. A bright white one dominated the view.

Chloe heard Pascal's gasp, and politely ignored it. She ran her post-transition

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pilot's checklist, as Pascal ran his own. When she heard him shift inside his port, she raised a hand to shield her eyes. A minute later, he was out of the port, though a little unsteady on his legs.

"Might I . . . get a little shut-eye? Unless you need . . . me here."

"Go, Pascal. You've got at least six hours." She shooed him out, then got working on scans.

They were ten light hours from the primary, twenty degrees below the system's ecliptic plane. All the planets were visible on line-of-sight, and Chloe ran preliminary sensor sweeps on them, working outward. The third planet stopped her dead.

"Pascal, I need you back here." She ran the protocol again, and got the same readings. She checked the ephemeris again, but the contradiction remained.

"What is it?" Pascal called petulantly from the corridor.

"The third planet doesn't match the catalog."

He trudged onto the bridge. "How doesn't it match? Different orbit? You get that sometimes with older surveys."

"Would an older survey ship miss an oxygen atmosphere?"

"What?" He peered over her shoulder. The catalog listed Zeta Doradus III as a habitable-zone world, with a Venusian atmosphere choking off its chances to bear life. The planet they were scanning had oxygen-nitrogen air, the oxygen partial pressure being almost an exact match of Earth.

"That can't be right," Pascal said. "No sensor suite could make a mistake that large."

"Then it wasn't a mistake," said Chloe. "Somebody falsified the records, either the Exploratory Commission, or the original surveyor himself: Mr. Shastri, forty-two years ago."

"No. He couldn't have. Besides, the second surveyor would have found the mistake."

"Unless she was in on it. That was Ursula Bosch, twenty-five years back." Chloe scrolled through one of her complates. "And she went missing thirteen years ago."

"Oh boy." Pascal leaned against the navigator's port. "Whoever falsified this had to do it immediately, either Shastri or the Commission. A habitable world—and this one sure seems habitable—would be too valuable to go unexploited for any length of time. It couldn't be a false record patched into the files after the fact." He blew out a breath. "Anyway, congratulations."

"For what?" Chloe asked.

"You found it, first place you looked."

"I guess we did. But what have we found?"

Pascal snatched some sleep while Chloe let the sensors tackle that question. Data trickled in slowly at that range, but the picture soon took shape. Moderate temperature range, slight axial tilt with two sizable moons to prevent excessive precession, and an orbit almost perfectly circular—at least according to the records, which apparently hadn't falsified that astronomical fact. The planet seemed perfect.

It also seemed empty. The ship picked up no transmissions, and there were no sizable artificial objects in orbit. If this was the base for a secret project, it remained secret for now.

Chloe waited for sensors to catch something more, but it only delayed her decision. She touched the intercom panel, then switched it off. She left the bridge, went to the door of her navigator's cabin, and knocked.

"Pascal? Pascal, I need your help."

It took a minute for Pascal to open the door. "What's the problem?" he mumbled.

"How soon after coming out of underspace could this ship go back in? If it had to leave in a hurry?"

Pascal perked up. "This is after a short, ten light hour jump, I assume?"

"Yes." She stepped aside to let Pascal past, and followed him back to the bridge.

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"The FTL engines would have some residual charge, especially after a mini-jump. They could power up faster than if they were starting cold." He sat down at the pilot's station to pull up some specs. "I'd say ninety seconds, if we weren't picky about where we were going."

"We wouldn't be. I assume we wouldn't get lost, or anything." His look answered the question. "Okay, I was just asking. You know your business."

"I do," Pascal said. "So, are we visiting the mystery planet?"

"Of course. We have to. It's only given us more questions, not answers."

Pascal left her seat, and opened up the port again. "How close?"

"Depends on how accurate you can be bringing us out."

"At this range? Within three thousand kilometers."

"Then make it good and close. Inside the lower moon's orbit."

"Aye aye." He nearly smiled, but something weighted down his mouth. He winced as the helmet made its connections, and his eyes focused somewhere beyond the cockpit.

They went into underspace again, the gray whorls creeping past. When they popped out, Chloe went right to the sensor readings, looking for anything that spelled danger. She found nothing. "All quiet," she said hopefully.

Pascal had his long stare again, but this time it had a focus, the planet filling most of the screen. Wisps of white drifted over expanses of blue, brown, and—it wasn't quite chlorophyll green, but closer to the aqua of clear, shallow seawater. "Lovely, isn't it?"

"Oh, yes. Let's give it a closer look." She set commands to enter a polar orbit, so they could scan the whole surface. "I'll need you to stay ready for a quick escape. I'm sorry."

"I understand."

Five minutes after swinging beneath the south pole, the sensors got a hit. "Detecting metals," Chloe said. "Significant concentrations—those are ships on the surface. Three, I count. And buildings nearby. Mostly small, but at least a hundred. We've found it!"

"Whatever it is," Pascal noted. "And if we can see them . . ."

"Gotcha. I'll raise our—"

The ship's radio crackled to life. "Unknown orbiting vessel," said a firm female voice, "please identify yourself."

Chloe and Pascal met each other's eyes nervously. "I think," Chloe said, "they'd react better to a navigator responding than a reporter. Call them back, and stay ready for transition."

Pascal sent the reply, giving the ship's name and registry number, and his name and navigator's license number. "Stand by," the planet said.

Pascal did not wait easily. "I think we should get away now."

"Not yet. I'll tell you when." She saw his hands tremble and hoped it was his built-up fatigue affecting him.

When the voice returned, his fingers moved toward the transition controls before he heard a word. "Pascal, your identity's confirmed. Welcome. You can set down at the field, pad five. A beacon will guide you in."

Pascal was a little stunned. "Copy that. Out." He turned to Chloe. "Do we—"

"Absolutely. I'm not walking away now." She cut off his protest. "We won't walk in blind, either. Can you handle the approach? I'm going to set up some precautions."

She didn't need long, and she was able to retake control at the edge of the troposphere. They approached over an uneven forest with patchy clearings. Near the horizon ran a wide silver-blue band, a slow river bordered by flatlands, then rolling meadows.

The forest resolved to individual trees as they passed below two kilometers. Thick dark boles supported leafy canopies that spread out like flattened mushroom caps or huge sea-green nail heads. Thinner layers from seasons past

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flashed through the gaps.

The trees gave way to ground cover, which yielded to a checkerboard of tans, beiges, and other earthy colors. Narrow roads led back to a small town, its streets laid out like spokes through concentric wheels. Off to one side lay a belt of tarmac, lined into six sections, half of them occupied by small FTL ships. A hangar stood nearby, close to the riverbank.

Chloe stayed attentive. Sensors had shown nothing resembling active weapons systems during approach, but now was the best time for a quick power-up and ambush. It never happened, as she settled their ship gently onto pad five. She ran her landing checklist, then rechecked her safeguards.

Pascal tottered out of the navigator's port. "If you expect me to be point man here," he said, "and you probably do, I should tell you I still don't know what this place is."

"Neither do I," Chloe admitted. "And you're the one they welcomed."

Pascal nodded. "So you'll be staying inside?"

"When there's a big story waiting outside? No chance," she said, grinning. "Besides, they'll know I'm here soon enough. Better to be forthright with them." She waved a hand. "After you."

The airlock hatch opened, letting in a bracing draught of outdoor air. A short ramp extruded down to the tarmac. As Chloe hung back, Pascal walked out, looking for a welcoming committee.

It came from the side, two men dashing over to grab Pascal. While one pinned his arms, the other made for the hatch. Chloe hit the button too fast for him. The hatch slammed shut.

She fumbled to activate the hull camera and the outercom. Pascal was protesting as the two men, both gray-haired but wiry and strong, thwarted his attempts to tear loose. "What is this?" she heard him shout. "What did I do?"

"You weren't passed to come here," one of them answered in a growl. "Who gave you our location?"

"No one!"

"You didn't find us by accident," the other said. "You'd better come clean. Who told you about us?"

"I did!"

The toughs turned toward the ship, still holding Pascal tightly. "Who are you?"

She summoned all the authority she could put into her voice. "Chloe Roberts, Inter-Info Network. Nobody had to tell me about your hideaway. I uncovered it myself."

One of the men groaned out a curse. The other shouted, "Captain! We need you here!"

From out of Chloe's camera angle, probably from the hangar, walked an older woman, her thick hair almost wholly white. She ignored the ship for the moment, concentrating on what her musclemen told her, then on their captive. Pascal returned the scrutiny, and his eyes went wide.

"I know you. You're Zhang Mei-zhi."

"That's right, Pascal," she answered with a faint smile.

"I didn't know you had disappeared. I thought you just retired."

The smile grew. "I did." She turned toward the hatch, spotting the camera effortlessly. "Ms. Roberts, I'm Zhang Mei-zhi. I run this place, to an extent."

Chloe studied the face. It showed no threat, for the moment. "Pleased to meet you. What is this place?"

"That's something I could explain better if I could show you."

"Oh no," Chloe said. "I won't leave the ship that easily."

"Please, Ms. Roberts. I don't want this playing out like a hostage situation."

"You're the ones who grabbed Pascal, after welcoming him to land."

The two men looked at Zhang, as if that rebuke might be enough to move Zhang to order Pascal released. She did turn his way, frowning in thought, then reviving her smile. "We can show you, Mr. Mesereau. You may understand bet-

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ter." She looked closer at him. "Unless you want to rest first. It looks like you had a difficult flight in."

Pascal thought a moment. "I . . . think I want to see a little of the place first."

Zhang nodded. "Orson, come along with us. Andrei, stay and keep an eye on the ship. Notify me if—"

Chloe seized their moment of distraction. She opened the hatch and bolted out. "Close!" she shouted back to the computer, which obeyed, sealing the ship. She ended up right in front of all of them, who stared at her.

"The ship's locked up tight," she told Zhang. "You won't get inside without Pascal and me."

Zhang's shock wore off quickly. "All right. But you won't get inside without our permission, either. Andrei." The stockier man moved to the bottom of the ramp, taking an alert, forbidding pose. "I take it," Zhang continued, "you'll be accompanying our tour."

"I wouldn't miss it. Now, as I already asked, what is this place?"

Zhang sighed. "Well, let me take—"

"You don't know?"

Pascal's question left Chloe baffled. "No," she said, noticing the looks Pascal and Zhang traded.

Pascal told her. "It's a retirement home."

The planet had no name, other than Zeta Doradus III. Rather, it had several names, but none had become fixed with its inhabitants.

"El Dorado was an obvious one, but it doesn't mesh with the purpose of the place." Zhang was in the front seat of an open car, with Orson driving and her guests sitting in the back. "Some call it Shangri-La, but we don't have any secrets of immortality here. One person called it the Secret Garden. I confess I like that one. Sentimentalism aside, it fits."

They were driving, not into town, but toward the fields Chloe and Pascal had overflown. Plots of several grains passed by, early in their growing seasons, just tall enough to sway in the breeze rather than bend. Chloe recognized wheat and corn, but couldn't place those stalks of a clayey red that reminded her of buttes in the Mojave. Beyond lay vegetable plots and a small orchard. Several residents were tending them with small farm machines, or by hand.

"It's a pretty active retirement for these people," Chloe noted.

"Farming's always been work," said Zhang. "We've got some good equipment, so it's not too much work. We've never lacked volunteers yet."

"Volunteers?" Chloe said. "For outdoor manual labor?"

Zhang chuckled. "If for forty or fifty years, your version of work was sitting motionless, plugged into a ship's computer, some healthy outdoor activity would be just the thing."

"She's got a point, Chloe." Pascal wore a big smile as he looked at the fields and the outskirts of the forest beyond. The nailhead trees were even more impressive from below, where one could see the branches rising level on level, buttressing the ones above. Their trunks were smooth, almost glossy, like something on Leviathan or New Chiron.

Chloe appreciated the beauty, but Pascal seemed mesmerized. She fought the urge to slap him and snap him out of it. "What told you this was a retirement community?" she asked instead.

"It seemed obvious, finally. Older navigators gathering together, no stations, no military bases. And Zhang said she was retired. What, you didn't believe her?"

Chloe didn't answer, instead aiming a barb at Zhang. "So you hid a whole habitable planet, perfect for colonization, from all of humanity, to form a farming commune?"

Zhang gave her a patient look. "We have more than agriculture here, plenty of necessary specialties. We aren't self-sufficient, but we're working toward it. As for being a commune . . . there was

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never a conscious decision about that, but perhaps we are. Maybe we're still small enough that we can function like one. Small enough for pure democracy to work, too."

"Not pure democracy," Chloe said. "You told me you run this place."

"To an extent. I'm just someone to handle day-to-day matters, or to act in emergencies, when something needs a quick decision."

"Like our arrival."

"Exactly." She tapped Orson's shoulder. "Get us back to town." He turned them around at a wide spot on the road.

Pascal was now looking past Chloe to watch the fields pass. "Ms. Zhang, how do navigators get to come here? Who tells them this place is here, and they're welcome?"

Zhang's smile receded. "We can't welcome all navigators, or people would know something funny was happening. We have to choose our candidates carefully, for how long they've worked as navigators, how much the work has worn them down, and how reliable they are, especially in keeping secrets."

"You can keep tabs on all that from here?" Pascal wondered.

"No. Navigators who are already in line to come here do the choosing. I won't tell you who they are. That's something you'd only learn if you found yourself tapped, since you'd be joining them in making those decisions."

"You mean they don't come here right away?" The idea apparently shocked him.

"A few do, if they can pay in immediately." That turned two heads. "We aren't Paradise here. You have to provide enough supplies and materials to support you however long you live here, and to maintain and improve the colony. It's a tidy sum: seven hundred thousand solars."

"That much?" Chloe gasped. "And people can still pay it?"

Pascal turned to her. "Experienced navigators can net that in eight years or so. And lots of navigators don't spend very much—though now I see why some of them don't."

He looked off into the distance. Chloe thought he was admiring the countryside again, but Zhang saw something else. "We can find you lodgings as soon as we're in town. We have empty houses awaiting permanent residents." She looked from Pascal to Chloe. "Where are you in your diurnal cycle?"

"Early afternoon."

"We're a little later. You'll have some time for rest, Pascal—and you, Ms. Roberts—before dinner."

Chloe heard a quiet emphasis there. "What happens at dinner?"

"You two will meet some more of our residents, and we'll have a discussion." She said no more.

Chloe was washed and ready by the time her escort knocked. Pascal and another escort were waiting with him. Together, they headed down a radial street from the town's edge toward the hub of the wheel.

They passed other houses, a general store, and the colony clinic. This acted as both a hospital and a home for the chronically infirm. Zhang was right, sadly: this was no Shangri-La. Age still took its toll.

Opposite the clinic, they passed a wedge of space given over to garden plots, sporting what had to be local flora. Chloe had never seen a bush with such parti-colored blossoms, or flowers with those helical stalks, anywhere else. She saw a set of small plaques at one corner, but passed too fast to read what they said. She didn't think it wise to hold up the procession to go back for a look.

They went to one wing of the small administration building and found the dining hall, or at least a room fitted out for dinner. The table seated ten, with six chairs already filled. The chairs and table had a familiar gloss to their wood. Zhang was seated, as were a few people Chloe

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had met or seen during her tour of the town. She sat at Zhang's left hand, near the head of the table, with Pascal taking the opposite seat.

"Glad you could make it," Zhang said. "The first courses should be out any moment."

Someone came through a side door with a trolley. She passed out salad bowls, put breadbaskets at each end of the table, and poured out water. She then took a seat and started eating with everyone else.

Chloe tried the salad, which had nothing she didn't recognize and was reasonably good. The bread was different, with a reddish color she remembered from the fields. She took one roll, broke off a small piece, and sampled it. It was malty, with a subtle smoky undertone. She tried more, and more, until she caught herself starting to bolt the bread.

"It is good, isn't it?" Oscar Menendez, the colony's carpenter, said to her left. He passed over a small jam pot. "Try the pryorberry preserves with it."

She did, and their extra-tangy plum taste won her over fast. "It's a shame you can't sell these," she said once her mouth wasn't quite full. "You'd make out very well."

"We actually considered it once," Zhang said, "but it's too risky. Besides, redgrass doesn't yield well enough for us to have surplus. We're improving it with good selective breeding, but that takes time."

"No recombination?" Pascal wondered.

"We're small. We have to pick what technology we can utilize. Our agriculture supports us well, so improving it is low priority."

"If this planet weren't a secret," Chloe said, "you wouldn't have to parcel things out."

Zhang inclined her white-topped head toward Chloe. The reporter noticed the red lump at her temple, where one of her jackports must have been before conductance links came into use.

"That isn't going to convince anyone here, Ms. Roberts. We need this place to ourselves. I hope we can convince you of that."

Chloe didn't sense a threat in Zhang's voice, but that didn't mean there wasn't one. "I'll be glad to listen," she said in her best open-minded voice.

Zhang didn't look persuaded of that. "How much do you know about navigators, Ms. Roberts?" she asked. "What they undergo in their work, how it affects them?"

Chloe fought not to glance over to Pascal. "More than the layman, I'd guess, but I'm not an expert."

"You couldn't be. You aren't a navigator. The common impression of the difficulties of a navigator's life is inadequate. There really is no conveying it. It must be like going through extended combat, or having a mental illness."

"The only people who really understand," Menendez said, "are the ones who experienced the same things. It leaves you lonely in a crowd. There's even a kind of loneliness when you're with fellow navigators. It's a group, but the group itself is isolated."

While Menendez talked, Chloe shot a questioning glance at Pascal. He gave the tiniest nod.

"Of course," Zhang said, "there's the counter-impression of navigators as this pampered elite, gouging a hundred worlds for a vital service they cannot get any other way. I'll admit there's good pay, and retreats at most ports catering to us. It's an attempt to compensate us. A good attempt, but one that has to fail.

"We can't explain the burdens. It's probably best that we can't. Humanity needs navigators, fresh trainees every year. If people knew, the applicant pool would dry up fast." Zhang turned to Pascal. "Tell her, Pascal. If you had really known what you were getting into, would you have thought twice?"

Pascal looked flustered at being put on the spot. His eyes met Chloe's, wavered, and sank. "Yes. Don't get me

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wrong. I'm in now. It's necessary work, and I wouldn't just walk away from it. But if I met the sixteen-year-old Pascal, and I could encourage him or warn him away . . . I'm not sure what I'd do."

Zhang patted his shoulder. "We recognize the need for navigators. We appreciate the duty we had. However, over time, other needs overcome that.

"That's why the Original Six—" She pronounced that name with implicit capitals. "—hatched their scheme, and founded this place, as a haven for navigators who had given as much as they could. They gradually let others in on the secret, gave them the chance to join them. Most did. A few have actually declined. None have ever given us away. They understood well enough why we needed this place.

"You understand it, Pascal," she said. He gave her the same small nod he had given Chloe. "You, Ms. Roberts," Zhang said, "are another matter. You're the first person to know about this world who doesn't implicitly understand. That makes this a dangerous moment for us."

The server had gone back into the kitchen during Zhang's speeches and was now back with the main course. They apparently had animals at the colony, because Chloe was served chicken with a light sauce, wrapped in what looked like lettuce except for the light bluish tinge. She took a sample and discovered a taste like arugula.

The serving and clearing of plates gave her time to formulate a reply to Zhang. "I don't dispute your desire for a pleasant retirement," she said. "I think you deserve one. But do you deserve a whole planet?"

"You've seen some of this world," said somebody down the table whom she didn't recognize. "Can you blame us for wanting this one?"

"I—no, but that isn't my point. All of this, for less than two hundred of you? There are plenty of colonies, Ms. Zhang, many crying out for new settlers."

"But not any new settlers. They want colonists who'll help them catch up to the pace of life on the established worlds. They're not interested in a group that takes it slow, that's old, that's unproductive, or isn't producing what they want produced."

"Not all colonies are like that."

"No," Zhang said, "but the traditionalist sects don't include others readily."

Chloe almost smiled. "Much like yourselves."

Zhang had the grace to look abashed. "Yes, much like ourselves."

Chloe took a few bites of dinner, to let that discomfort fade. "You say you had six original founders. Really, it had to be one. Prahlad Shastri discovered the system forty-two years back, and logged false scans of this planet. He knew what he was doing from the start."

There was a murmur down the table, which Zhang ignored. "That's true. He had help building the colony, but Prahlad conceived it. He is our one true founder." She pointed down the table. "That's his seat, in fact."

Chloe looked at the foot of the table. The chair there was the only one unoccupied. "A symbolic gesture?" Chloe said. "Present in spirit?"

"A nice sentiment," Zhang answered, "but no. He just wasn't up to joining—oh, so you were."

Chloe's head was the last to turn to the main door. A brown, slightly stooped man, with the barest fringe of white hair, stood propped against the doorway. A face crowded with wrinkles told of great age, past a hundred and five, if Chloe remembered the records correctly.

"Oh my," he said in a soft, piping voice. "I'm sorry, Mei-zhi. I seem to have missed everything."

Zhang left her seat to take him by the hand. "Nonsense, Prahlad," she said, and turned to catch Chloe's eye. "You're right on time."

"I don't know how long I had the idea of a navigators' sanctuary. When I had

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my first good look at this planet, it seemed to spring from the depths of my mind, fully made from years of imaginings."

Chloe and Pascal were in Prahlad's home, on the invitation he gave before dinner had ended. It was small and cozy, with lived-in wear. They all sat at his small kitchen table, sipping his herbal tea.

"You really knew from the start you could pull this off?" Pascal asked. He had been fascinated by Prahlad's arrival at dinner and peppered him with questions. His animation was fast winding down, but it revived in spurts.

"I knew nothing," Prahlad said, "except that it was worth the effort. We navigators were giving humanity so many new worlds. I wanted one for us, one for myself. I needed, and I was right in thinking others needed, a place that would fill what the links emptied, to close up what they had laid open."

Chloe reflexively shifted her eyes. It was too easy to look at his jackports, never uninstalled from his skull, open holes in his flesh.

Prahlad saw the aversion. "You are too polite, Ms. Chloe. I'm not ashamed of my ports. They are a part of my being."

"Of your past," Chloe said.

"Actually, my old scout is still here. I fly it sometimes, when we need it to bring in a new member." He thought. "Well, not for seven years now, so yes, it is part of my past. But the past is part of me, as much as the present moment is. For forty years—"

He stopped, looking at Pascal. The young navigator was nodding, the cup tipping in his hand, dribbling tea onto the tabletop. Prahlad gently took the cup from his hand, which roused Pascal.

"I'm sorry, Captain Shastri. I . . . uh, I . . ."

"Have they given you a room, Master Pascal?"

"Huh? Yes. I got some sleep there earlier."

Prahlad was up. "Get some more. Come."

"But I—" Pascal's protest died under Prahlad's gentle eyes. He obeyed Prahlad, following him to the door, his head hung in mortification.

There was a brief exchange with the guard outside the door. Prahlad's "She will be fine with me," was the only part Chloe made out. He was back a moment later. "He thinks he's weak," he said, gingerly lowering himself back into his chair. "He will learn. He has time.

"And I was speaking of time. For forty years, I was a navigator. For almost forty years, I have lived in retirement here. I finally feel my life is balanced. Perhaps it will not take as long for young Pascal to reach his balance."

"If he's chosen to come here," Chloe noted.

"I choose him. The colony will honor that. Whether we will still be here when he is ready to claim the privilege is, naturally, a different matter."

His eyes were soft, but Chloe felt like that showed how trivial it was for them to see right into her. "Would this colony truly be destroyed," she asked carefully, "if it ceased to be secret? There's no reason why you couldn't live alongside other people, at least with a piece of the world set aside for yourselves."

"No. We would lose control over this place, and that would destroy it. Consider, Ms. Chloe: if all navigators knew this place existed, most of them would want to come here, many as soon as they could manage it. They would be navigators for ten or twenty years, then live here for fifty or sixty. It would overturn the balance. More, it would drain navigators from the starlanes, produce a crisis."

"But you could still restrict who comes here, by time of service or a higher residence fee, or both, or more."

"Ah, but now we are under the scrutiny of outside authorities," Prahlad said. "If they think our policies are unfair in any particular, they will overrule them, strip our autonomy. We won't be able to

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decide which navigators may come live here. We won't be able to keep it to navigators alone, if they wish otherwise."

He sipped some tea. "They could even decide that our skills are too important to allow us to withhold them. We are so crucial to interstellar unity, after all. It would scare them to think that navigators could simply walk away from their duties." He looked into his cup. "I understand that fear. That is why I don't want to give it a chance to grip them, to make them act out of that fear."

He put his half-full teacup aside. "So many things can go wrong. We might avoid one hazard, or two. We wouldn't avoid them all. The delicate balance we've struck would vanish. No, we must remain secret.

"Being navigators set us apart, long before this. Our best hope for safety and security lies in remaining apart. It is not an ideal solution, but it is the best we can reach without risking all." He smiled. "It requires an act of philosophy. Once you can accept what is possible, you will accept what *is*."

Chloe nodded slowly. It was a lot to absorb, and she didn't want Prahlad thinking she had fallen asleep like Pascal. "Well," she finally said, "that's all about the future, or what it could be. I'd like to know more about your past here. How difficult was it to found this colony? How hard was it to find navigators you could trust to help you with such an undertaking?"

Prahlad let a sigh escape. "I'm sorry, Ms. Chloe. These questions will have to wait."

"Why, sir? Are you holding back secrets? Are you uncomfortable?"

"What I am," he chuckled, "is tired. My tea always makes me sleepy."

Chloe rose a beat behind Prahlad, with the same slow care. "I really would like to continue, Captain Shastri."

"I know. There is always tomorrow." He chuckled again. "At least there always has been so far." He patted Chloe's arm. "Go and rest, please."

* * *

Chloe woke slowly to a sunrise that crept into her bedroom. She lingered in the rays cast through the window as she walked to the bathroom. She often had trouble sleeping her first night on a new world, station, or ship, but she hadn't here. Maybe Prahlad's tea had done that.

She rethought all that had happened last night as she washed herself . . . and an unaccountable sense of dread began creeping over her. She dismissed it as stray morbidity, but within moments she was hurrying to finish her shower. Dressing went even faster, and she all but dashed out the front door.

The guard outside was stunned, briefly. "Hey! Where are you going?"

"Shastri," she called over her shoulder. She was running, slowly enough that her sentinel could keep pace, and slowly enough that she didn't feel completely like a fool. She certainly would if she were imagining all this, as she hoped she was.

Three colonists were outside his door. Chloe recognized Zhang. She hadn't been crying, but she looked ready to start.

Chloe coasted to a stop a pace from Zhang. "Is he . . . ?" Zhang nodded, shaking the first tear loose.

There was a shuffle inside. Oscar Menendez and another man gently bore out a sheet-draped form. "The cart will be here in a moment," Zhang told the men.

Chloe stared at the shrouded body. She had chased this man all the way from Earth, without knowing it was he she was chasing—and now he was dead. She heard the guard come up next to her, and gasp. She felt the same way.

"I was so blind," she said. "I think he knew he was going last night."

Zhang rubbed at her eyes. "It wouldn't surprise me. There's so much to the—was so much. Was." She turned away, pulled herself together, and whispered something to Prahlad's bearers before returning her attention to Chloe.

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"The funeral will be in a few hours. We don't procrastinate over such things here. Could you please tell—"

"Of course." Chloe walked away, slowly, needing the time to figure out how to break it to Pascal.

Over half the population had to be there, and they were still streaming in. Chloe watched some coming out of the clinic, two driving themselves in support chairs, a third being pushed along by an attendant. The only residents not coming, she suspected, were a few who would soon join Shastri in death.

She and Pascal walked together toward the gravesite. Pascal was looking better now, after having been almost catatonic at one point. He was crushed at losing the chance to talk more with Shastri, a man he had admired before coming here, and now all but worshiped. He hadn't said those things, but the texture of his self-recriminations had made them plain.

Pascal plucked at his tunic, and looked reproachfully behind him. They still hadn't been allowed to enter their ship, even for a change of clothes in which to attend the service. The guard who had been watching the ship was a couple of dozen paces behind them. He'd be at the funeral, as long as they were.

They arrived at the plot adjacent to the administration building. Through the bodies circling it, Chloe could see five plots of native plants, and one fresh, shallow grave. "I just need to see something," she whispered to Pascal, and started threading through the crowd.

She found the plaques she had seen before, and could now read them. They were no surprise: "Kantaro Koizumi/2257—ZD 6," "Aliyah Qawi/2260—ZD 18," and the like. The rest of the Original Six.

Chloe started back toward Pascal, only to find he had accompanied her. He reached out to touch the space without a plaque, where one would soon go. Then they shifted back, ceding that prime space to the others.

Soon the pallbearers came, four of them carrying the shrouded body of Prahlad Shastri. Zhang and a few others followed at a respectful distance. The pallbearers laid the body next to the grave, and one of Zhang's companions stepped forward. Chloe recalled him from dinner, but she couldn't think of his name before he spoke.

"I can say little about Prahlad Shastri that you don't already know, and if I said all that I could say, it would take me until nightfall." There was a rustle of something close to laughter.

"He was a man of layers. There was the everyday man of quiet, unassuming wisdom. Just beneath that was the man of daring and determination, taking big chances for a big dream. Beneath that, there lay the man of rock-hard work ethics, who poured his labor into building that dream into reality, for as long as his body would let him. There were so many other parts to him, but those are the ones we will always remember, because they—he—made a world for us.

"He was our Moses, only he did not die with merely a sight of the Promised Land to comfort him. His forty years in the wilderness, he spent making that wilderness into a home and haven."

He swallowed to clear his throat. "We owe him everything, but as he often told us, he considered the debt paid in full. In creating what we needed, he found what he needed: a life lived in balance. May we all be as fortunate."

The pall-bearers unwrapped one layer of the shrouds, then carried Shastri until he was positioned just over the grave, two of them holding the shroud on each side. As they knelt to start lowering him, the eulogist began a recitation.

"Forasmuch as it hath pleased God of his great mercy to take unto himself the life of our dear friend here departed, we therefore commit his body to the ground: earth to earth, ashes to ashes . . ."

Chloe knew the words, but it was

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strange to find them spoken here. They continued as Shastri settled into the ground, and his bearers draped the ends of the shroud they had used to lower him back over his body. Once that was over, a woman put a spade into the mound of soil mounted up near the grave, and pitched in the first clod.

Chloe heard the sob. Others had been crying, but Pascal had been quiet until then. She found his cheeks already wet, and he trembled with every breath. She pulled him close, letting him weep on her shoulder, holding him like they were part of the same bereaved family.

Several people were filling the grave, but nobody had left the service. Chloe found that strange, but said nothing. By the time Pascal cried himself out, the ground over Prahlad was level.

The eulogist stepped forward, pulling two small objects from his pockets. The first he tore open, sprinkling its contents on the soil. By the time Chloe realized they were seeds, he had knelt to plant his second object. It was a small flowering plant, with two bright yellow blooms growing Janus-headed from the same stalk.

He stood up again, slowly with his age. "Thank you all for coming," he said, and that fast, it was over. The crowd began milling, some drifting closer to the grave, some gathering in knots, only a few leaving.

Chloe gave Pascal a squeeze. "Come on, let's get you back to your quarters."

He resisted her pull. "I . . . actually, I'm going to stay here a while." He slipped out of her arm, and hesitantly approached a trio of navigators. He caught their attention, which was rather wary of the obvious outsider. Pascal coughed. "Could you . . . tell me about Captain Shastri?"

Three faces brightened. "Where do we start?" one of them said. They pulled him into their circle. Chloe slipped away. Pascal didn't need her now.

She made her way toward Zhang, who had a lot of people around her. Chloe was ready to be patient, but Zhang spied her, made excuses, and joined her. "You look like you have questions, Ms. Roberts."

She hadn't, but Zhang's gambit revived one. "Was Shastri really Christian? He struck me as . . . something else."

Zhang got them walking away from the crowd. "Early on, the original colonists settled on this way of handling the dead: the gardens, I mean. Shastri was brought up Hindu, where they immolate bodies. He gave that up. Christianity was, I think, an aesthetic choice: returning to the earth, a rebirth into a gentler life. If he truly believed, well, that's something only he knew."

Chloe nodded, filling the time so she could think. "Shastri told me last night that he chose Pascal to come here, when the time was right. I don't imagine he had a chance to convey that decision to you, so I'm doing it now."

"Really," Zhang said. "We'll honor that, naturally. Of course, there's an assumption that goes with that, one that isn't quite confirmed yet."

"Shastri mentioned it himself." Chloe sighed and looked at the ground. "I'll keep your secret. I'm sure Pascal will, too."

Zhang waited for Chloe to look up. "What convinced you?"

"I don't know. I was still a skeptic when I went to bed last night, but now . . . I know what burying this story could mean for my career, but it doesn't seem to matter. I guess Shastri convinced me after all." Her eyes fell again.

Zhang patted her shoulder. "He had that effect on most people. I'll speak to Pascal about this, but I'm sure he'll be with you."

"So am I," Chloe said. "We won't impose any more on your hospitality, not at a time like this. We'll leave as soon as you like."

"Tomorrow, I think. We need to vote on letting you depart, but with me behind it, it'll pass." She looked past Chloe. Pascal was still talking with the

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trio, more animated, a smile peeking out on his face for a moment. "And he'll appreciate the extra time, don't you agree?"

Chloe said the only thing she could. "Of course."

The previous night's rain persisted as a morning drizzle, so the car driving them back to the landing field was closed-topped. Zhang drove, so Andrei could keep an eye on the departing guests in the back seat.

They were still cautious. Before leaving her guest house, Chloe had been searched and scanned for recording devices, data storage, even biological samples like a grain of redgrass or a splinter of local wood that would help confirm a story of a secret colony. She assumed Pascal had gotten the same treatment.

"Remember, Pascal," Zhang said, "don't try to identify any of our recruiters. When the time comes, they'll find you."

"I know," Pascal said in a monotone.

They pulled up close to the scout ship. It still had a guard at the hatch, who didn't move while the car emptied. Chloe walked around the back to get to Zhang.

"Even if I can't tell people about this world," Chloe told her, "I'm glad I got to see it. Thank you for your hospitality."

"And thank you for your decision. Have a safe trip. Orson, you can come away now."

The soaked guard cleared the way. Chloe and Pascal climbed the ramp, and placed their right hands on the ID plate at the hatch. The combination worked, and the hatch eased open. She half expected them to ascend the ramp after them, to search the ship. Instead, they were already in the car, turning around.

Chloe headed off Pascal going to the bridge. "I'll launch us. Get some new clothes."

"That obvious?" Pascal said, but he obeyed. Chloe got into the pilot's seat and checked the computer logs. No sign of entry since their arrival, and no sign of tampering in the log. That settled, she ran her checklist, gave Pascal an intercom warning, and lifted the ship.

She kept the forward view and flight data on the main viewer, but had the departing angle on a sub-monitor. Overcast as her view was, the beauty of the place was undiminished.

Pascal arrived in a fresh jumpsuit while the ship was still in the upper stratosphere. "I'll take over piloting," he said, "and let you get your own change."

"Thank you." She gladly yielded her seat, went to her cabin, and got rid of her own overly familiar jumpsuit. She took a moment picking a new outfit, something not quite as lifeless.

"Altitude nine hundred kilometers," Pascal reported when he heard her reenter the bridge. "Just getting us on course for Zeta Reticuli. There."

He relinquished the seat, to move over to the navigator's port. Chloe saw him give her a quick up-and-down look before opening the chair. She remembered to look aside while he got himself settled.

"Thanks," he said, and she looked back. "FTL engines need to complete charging, then we can drop into underspace." He worked for a moment before his eyes slipped back toward her. "Is that for my benefit?"

"Uhh, not entirely," she improvised. "I felt like showing a flourish of youth, no offense to them."

"Hm." Pascal went deep into thought, almost looking like he was linked when he wasn't. "You must have been persuasive, telling Zhang you wouldn't expose the settlement."

"I suppose I was."

"You had to be." Pascal looked over his console. "You were lying, weren't you?"

Chloe was stunned. She began to answer, then checked herself. "Yes," she finally said. "We could never have gotten away otherwise. They would have had to silence us somehow."

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"'Silence?' Your way of saying 'kill?' They wouldn't have done that."

"You haven't been around many people whose deepest secrets you've uncovered."

"Yes, that's right. You have a way of getting into people's confidences." Still Pascal would not look at her. "Why are you going to expose them? Or should I say, what do you gain?"

Chloe got angry despite herself. "Pascal, they didn't have the right to do what they did, however worthy their aim. Planets that can support open-air colonies—planets that similar to Earth itself—aren't so common that humanity isn't going to miss one. People won't be so indifferent that they wouldn't care if they weren't permitted to live there. *I* half want to live there, after two days!"

"So that's it? You want it, so you're going to take it from us?"

"*They* took it! They didn't ask, or propose, or lobby. They took it, and put lies into the public record to cover up the fact. They used their professional positions—they abused their power—to profit themselves.

"And please," she said, cutting him off, "don't plead the worthiness of their cause. If all it takes to disregard duties and violate trust is to *think* you have a good reason, that can justify almost anything. It usually has, all through history, ancient and recent alike."

Pascal's face was a hot red. "Well, if some old navigators are a bad example to criminals and tyrants, that settles the matter. No point in trying to dissuade you."

Chloe felt his mockery like acid in her gut. "Pascal, I'm sorry. Navigators may have a hard life, but it doesn't mean they deserve a whole planet to compensate. Or maybe it does, I don't know, but they aren't the ones who get to decide that."

Pascal's eyes remained resolutely forward, and his jaw was clenched hard enough to crack his teeth. Chloe felt a sense she had learned during the Kuiper Revolt, that someone was turning dangerous. "Pascal," she said, "I need to know that you aren't going to do something rash."

He shot her a deadly glare. She froze under it. Then he blinked, turned away, and brought the inductance helmet down to his head. "You don't have to worry, Ms. Roberts. You hired me for a job, and I'll complete it. Navigators do their duty."

"Pascal, I—"

"Engines charged. FTL transition . . . now." His eyes went glassy, looking at nothing but the gray infinity of underspace. .

Chloe gave up and let him sit in silence. Further talk now would only isolate him more. She would wait for him to say something first.

Twelve hours later, when she finally went to bed, he still hadn't spoken.

Sleep wouldn't come for Chloe. She lay in bed for over an hour, waiting for it. She thought she finally drifted off, but awoke again with sleep more distant than before. She sat up, massaging the dull ache in her temples, wondering how she would get through the night.

She heard something. She kept still, waiting, and heard it again. Was that coming from the bridge? Better than a strange noise from the engines.

She left her cabin, quietly as she could, and tiptoed toward the bridge. Rather than open the door, she slipped up to the bulkhead and put an ear against it. She heard a muffled voice, droning, exclaiming, and once moaning.

Now Chloe was worried. She stepped through the hatch, in mid-sentence for Pascal. He didn't notice.

"—lost, lost . . . could've waited . . . forty, fifty years, I could have . . . knowing it was there . . . given me strength . . . how will I endure now? How . . . ?" Words gave way to a trembling sigh.

Chloe was transfixed. Was Pascal having a breakdown? A mentally unhinged navigator was a danger too horrible to contemplate. If his emotional state and that eerie detached voice were anything

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to go by—

No, she had heard that voice before. Pascal was in half-sleep, and this stream of consciousness was—what? The emotional half of his brain, like the analytical half she had heard before? That old duality theory of the brain hemispheres had taken some knocks, but right now she believed it unreservedly.

". . . decades of this . . . what's at the end? . . . same as before . . . should never have seen . . . false hope . . . this all my life will be? . . . Chloe!" She froze at the word, hurled like an accusation. Had he noticed her?

"Chloe, why? . . . thought you cared . . . thought you . . . me . . . stupid . . . should have known . . . my fault? Ohhhh . . ." He dissolved completely into sobbing moans, but his posture never slumped, his eyes never left their fixed line.

Chloe slipped out and wouldn't let herself think of what she had witnessed until she was back in her cabin, standing in the dark. Then she had to think about it.

It might have been two minutes, or twenty, before she turned on a light and found something to write with. She always liked to sketch out a story before she committed it to video files, and this one would need more than usual.

Much of her thesis was unchanged. People needed to know what Shastri and his band had done, how they had gone around the Exploratory Commission they were supposed to be serving, how their colony was tapping the pool of navigators to this day. Given that set of facts, the response was in little doubt.

That was why she had to deliver more than those facts. That was why the navigators needed an outside advocate to plead their case. They needed her.

This wasn't how she did business. She prided herself on letting facts speak for themselves, even when she went in expecting, even hoping, they would speak a certain way. She knew plenty of agenda journalists, and was glad at how few media critics counted her among them.

That was about to end. All she could do to mitigate it was to be honest about taking sides, and bend every effort to lay out everything that mattered in the story, even the parts that could hurt the navigators' cause.

With all the evidence before the public and the authorities, there could be deliberation, rather than a foregone verdict. The navigators would have a chance to preserve what they had built. The rest of humanity would have a chance to regain some of what they had been denied for four decades. There might even be a solution that satisfied everyone. Stranger things had happened, and Chloe hoped it could happen here.

She was still betraying her word to Zhang. Chloe had come to terms with that the day of Shastri's funeral. What she hoped to soften was her betrayal of the man on the bridge.

Chloe would tell him her plan in the morning, in hopes that he would help her with it. If he scorned her offer, she wouldn't blame him. He had had his hope for the future ripped away, along with whatever trust, or more, he'd had in her. She wasn't going to get that trust back. Maybe, though, she could give him back his future.

That would have to be enough. ■

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Rollback

Part II of IV

Robert J. Sawyer

Actually getting something you've always wished for but never expected can be fraught with complications.

THE STORY SO FAR:

The year is 2048. ***Sarah*** *and* ***Donald Halifax****, both eighty-seven, are celebrating their sixtieth wedding anniversary with their children and grandchildren at their Toronto home. Don is melancholy: he knows that this is the last milestone anniversary he and Sarah will be around for; their lives were good and full, but now are drawing to a close.*

Back in 2009, Sarah, then a professor of astronomy at the University of Toronto, had decoded the only radio transmission from another star ever detected by the SETI project—a message from Sigma Draconis, 18.8 light-years away—and she orchestrated Earth's reply to that message. A phone call comes during the anniversary party. As the astonished Sarah relays to her family: "The aliens from Sigma Draconis have responded to the radio message my team sent all those years ago."

Incredibly, though, the new message is encrypted*—scrambled so that it can't be read without a decryption key. It's baffling: the whole point of SETI is to send messages that will be easy to read; the notion that a message would be designed* not *to be read makes no sense to Sarah.*

The media begin inundating Sarah with phone calls—everyone wants to know what "the Grand Old Woman of SETI" makes of this; Sarah ignores the calls. But she's intrigued when a humanoid robot shows up at her door. Sarah has often said that SETI depends on the kindness of strangers, and one of the most generous of those strangers has been ***Cody McGavin****, the billionaire founder of McGavin Robotics. He's sent this robot, carrying a cell phone, because he wants to talk to Sarah. She accepts his call, and he says he's got a*

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proposal for her, and wants to fly her and Don down to Cambridge, Massachusetts, where his company is headquartered.

Astonished, Sarah agrees, and she and Don meet with McGavin in his office. Sarah, according to McGavin, is the key to communicating with the aliens. Four decades ago, she was the one who figured out what the aliens were asking in their original message, and he's sure that she'll be pivotal in cracking the current one.

As McGavin says, "Planets don't talk to each other. People *do. Some specific person on Sigma Draconis II sent the message, and one specific person on this planet—you, Dr. Sarah Halifax—figured out what he'd asked for, and organized our reply. You've got a pen pal, Dr. Halifax. It happens that I, not you, pay the postage, but he's* your *pen pal."*

And so, McGavin says, Sarah needs to be around for subsequent exchanges of messages, even though, because of the speed-of-light time lag, decades will elapse between each one.

Don thinks McGavin is being both ridiculous and cruel, and tells him so: he and Sarah both know that they have only a few years of life left.

Maybe not, says McGavin. He offers to pay for a rollback *for Sarah: a new technique that can rejuvenate a person. It costs billions, but it'll return Sarah to being physically in her mid-twenties, giving her many decades of additional life to continue the dialogue with the aliens.*

Sarah is startled but intrigued. But she immediately sets out one nonnegotiable condition: McGavin must also pay for a rollback for her husband Don. McGavin initially balks—Don was an audio engineer and producer for CBC Radio before he retired; he's of no use to the SETI effort, and the process is supremely expensive. But the rich man relents, and, after considerable soul-searching, Sarah and Don agree to undergo the procedure.

Tragically, though, the procedure works for Don, but not for Sarah. Rejuvenex, the company that performed the treatment, thinks the failure of Sarah to become young again may be related to experimental therapies she underwent decades previously for breast cancer—but regardless of the cause, there's nothing they can do. Although it'll take months for Don's rolling back to complete, it's inexorable: he's going to end up being physically in his mid-twenties, while Sarah will remain in her late eighties.

The current message from Sigma Draconis remains unreadable, locked behind an encryption algorithm that the aliens have clearly explained in a header to their message but to which they've failed to provide the decryption key.

In trying to figure out what that key might be—and to keep her mind off the growing age gap between her and her husband—Sarah spends a lot of time contemplating the first message from Sigma Draconis, received way back in 2009. In it, the aliens established that although it's technically correct to write the result of the question "What is eight divided by twelve?" as either 2/3 or 4/6, the answer 2/3 is preferable *(because the fraction has been reduced). They also established that whether the number one is or isn't a prime number is a matter of opinion. This mathematical vocabulary allowed them to explore moral issues in the rest of their message. Sarah vividly recalls the fateful day all those years ago when she finally figured out exactly what the first message was, and what sort of reply the aliens wanted . . .*

Chapter 13

To be young again! So many had wished for it over the years, but Donald Halifax had achieved it—and it felt *wonderful.* He knew his strength and stamina had ebbed these past several decades, but

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because it'd happened gradually he hadn't been conscious of how much he'd lost. But it had all come rushing back over the last six months, and the contrast was staggering; it was like being on a caffeine jag all the time. The term that came to mind was "vim and vigor"—and, although he'd played "vim" often enough in Scrabble, he realized he didn't actually know precisely what it meant, so he asked his datacom. "Ebullient vitality and energy," it told him.

And that was it! That was precisely it! His energy seemed almost boundless, and he was elated to have it back. "Zest," another word only ever employed on the Scrabble board, came to mind, too. The datacom's synonyms for it—keen relish, hearty enjoyment, gusto—were all applicable, but the cliché "feeling like a million bucks" seemed woefully inadequate; he felt like every one of the billions of dollars that had been spent on him; he felt totally, joyously, happily *alive.* He didn't shuffle anymore; he strode. Just walking along felt like the way he used to feel on those motorized walkways at airports—like he was bionic, moving so fast that it'd all be a blur to onlookers. He could lift heavy boxes, jump over puddles, practically fly up staircases—it wasn't quite leaping tall buildings in a single bound, but it felt damn near as good.

And there was icing on this delicious cake: the constant background of pain that had been with him for so long was *gone;* it was as though he'd been sitting next to a roaring jet engine for years on end, always trying to shut out the sound, to ignore it, and now it had been turned off; the silence was intoxicating. Youth, the old song said, was wasted on the young. So true—because they didn't know what it would feel like once it was gone. But now he had it again!

Dr. Petra Jones confirmed that his rollback was complete. His cell-division rate, she said, had slowed to normal and his telomeres had gone back to shortening with each division, a new set of growth rings was starting to appear in his bones, and so on. And the follow-up work had been completed, too. He had new lenses, a new kidney, and a new prostate, all grown from his own cells; his nose was restored to the merely honker-esque proportions it'd had in his youth; his ears had been reduced; his teeth had been whitened and his two remaining amalgam fillings replaced; and a few nips and tucks had tidied up other things. For all intents and purposes, he was physically twenty-five once more, and aging forward normally from that point.

Don was still getting used to all the wonderful improvements. His hearing was top-notch again, as was his vision. But he'd had to buy a whole new wardrobe. After the recalcification treatments and gene therapies, he'd regained the two inches he'd lost over the years, and his limbs, which had been reduced to not much more than skin and bones, had beefed up nicely. Ah, well; his collection of cardigans and shirts with buttons would have looked silly on a guy apparently in his twenties.

He'd had to stop wearing his wedding ring, too. A decade ago, he'd had it reduced in size, since his fingers had gotten thinner with age; now, it pinched painfully. He'd been waiting until the rollback was over to get it sized back up, and he'd get it done as soon as he found a good jeweler; he didn't want to trust it to just anyone.

Ontario had mandatory driver re-testing every two years starting at one's eightieth birthday. Don had failed the last time. He hadn't missed it, and, besides, Sarah was still able to drive when they really needed to go somewhere. Now, though, he probably should take the test again; he had no doubt he'd pass this time.

At some point, he'd also have to get a new passport, with his new face, and new credit cards, also with his new face. Technically, he'd still be entitled to seniors' discounts in restaurants and at

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movies, but there'd be no way to claim them without convincing incredulous waiters and clerks. Too bad, really. Unlike, he was sure, every other person who had undergone a rollback, he really could use the break.

Despite all the good things, there *were* a few downsides to being young again. Sarah and Don were spending double on groceries now. And Don slept more. For at least ten years, he and Sarah had been doing just fine with six hours' sleep each night, but he found he needed a full eight again. It was a small price to pay: losing two hours a day, but gaining an extra sixty years. And, besides, presumably as he aged the second time, his sleep and food requirements would lessen again.

It was now a little after 11:00 P.M., and Don was getting ready for bed. Usually, he was quick in the bathroom, but he'd gone out today, and it had been hot and muggy. Toronto in August had been unpleasant when he'd been a kid; these days, the heat and humidity were brutal. He knew he wouldn't be able to sleep well if he didn't first have a quick shower. Carl had installed one of those diagonal support bars for them several years ago. Sarah still needed it, but Don now found it got in the way.

He shampooed, quite enjoying the sensation. He now had a full head of inch-long sandy-brown hair, and he just loved the feel of it. His chest hair was no longer white either, and his other body hair had lost its grayness.

The shower was sensuous, and he luxuriated in it. And, as he cleaned himself down there, he felt his penis growing a little stiff. As the water ran over him, he idly stroked himself. He was thinking of finishing himself off—that seemed the most expedient course—when Sarah entered the bathroom. He could see her through the translucent shower curtain; she was doing something over by the sink. He rinsed the soap off, his erection fading as he did so. Then he turned off the water, pulled back the shower curtain, and stepped out of the tub. He was used by now to being able to swing his legs one after the other over the side without it being painful, and without—as he'd been doing in the preceding few years—sitting on the edge of the tub while doing so.

Her back was to him. She was already dressed for bed, wearing, as she always did in summers, a long, loose red T-shirt. He grabbed a towel from the rack and vigorously dried himself off, then headed down the short corridor to the bedroom. He'd always been a pajama man, but he lay naked on top of the green sheets, looking up at the ceiling. After a moment, though, he felt cold—their house had central air-conditioning, and an outlet vent was directly above the bed—and so he scurried under the sheets.

A moment later, Sarah entered. She turned off the light as she did so, but there was enough illumination seeping in from outside that he could see her moving slowly to her side of the bed, and he felt the mattress compressing as she climbed in. "Good night, sweetheart," she said.

He rolled over on his side, and touched her shoulder. Sarah seemed surprised by the contact—for the last decade or so, they'd had to plan sex in advance, since Don had needed to take a pill beforehand to kick-start his lower regions—but soon he felt her hand gently on his hip. He moved closer to her and brought his head down to kiss her. She responded after a moment, and they kissed for about ten seconds. When he pulled away, she was lying on her back, and he was looking down at her while leaning on one elbow.

"Hey," she said, her voice soft.

"Hey, yourself," he said, smiling.

He wanted to bounce off the walls, to have wild, athletic sex—but she wouldn't be able to stand that, and so he touched her gently, softly, and—

"Ouch!" she said.

He wasn't sure what he'd done, but

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he said, "Sorry." He made his touch even lighter, more feathery. He heard her make a sharp intake of breath, but he couldn't tell if it was in pain or pleasure. He shifted positions again, and she moved slightly, and he actually heard her bones creak.

The activity was so slow, and her touch so weak, that he felt himself going soft. While looking into her eyes he vigorously stroked himself, trying to get his erection back. She looked so vulnerable; he didn't want her to think he was rejecting her.

"Tell me if this hurts," he said as he climbed on top of her, making sure that his own arms and legs were bearing almost all his weight; he wasn't the least bit fat, but he was still much heavier than he'd been before the rollback. He maneuvered carefully, gently, looking for a sweet compromise between what his body was now capable of and what hers could endure. But after only a single thrust, one that seemed oh-so-gentle to him, he could see the pain on her face, and he quickly withdrew, rolling onto his back on her side of the bed.

"I'm so sorry," she said, softly.

"No, no," he said. "It's fine." He turned onto his side, facing her, and very gently held her in his arms.

Chapter 14

Sarah had leapt from her chair in the basement on that fateful night all those years ago, and Don had hugged her, and lifted her up so that her feet weren't touching the ground, and he'd swung her around, and he kissed her hard, right there, in front of the kids.

"My wife the genius!" Don declared, grinning from ear to ear.

"More like your wife the plodding researcher," replied Sarah, but she was laughing as she said it.

"No, no, no," he said. "You figured it out—before anyone else did, you figured out the meat of the message."

"I've got to post something about this," she said. "I mean, it's no damn good if I keep it a secret. Whoever announces this publicly first is the one who . . ."

"Whose name will be in the history books," he said. "I am *so* proud of you."

"Thanks, darling."

"But you're right," he said. "You *should* post something, right now." He let her go, and she started to move back to the computer.

"No, Mom," said Carl. "Let me." Sarah was a hunt-and-peck typist, and not a very fast one. Her father, back in Edmonton, had never understood her wanting to be a scientist, and had encouraged her to take all the typing she could so she'd be ready for a secretarial career. A single typing course had been mandatory. It was the one class in her whole life that Sarah had failed.

She looked at her teenage son, who clearly, in his own way, wanted to share in this moment. "Dictate what you want to say," Carl said. "I'll type it in."

She smiled at him, and began pacing the length of the rec room. "All right, here goes. The meat of the message is . . ."

As she was talking, Don ran upstairs and called an overnight news producer at the CBC. By the time he returned to the basement, Sarah was just finishing dictating her report. He watched as Carl posted it to the SETI Institute newsgroup, then Don said, "Okay, hon, I've got you booked for a TV interview in one hour, and you'll be on both *The Current* and *Sounds Like Canada* in the morning."

She looked at her watch. "God, it's almost midnight. Emily, Carl, you should be in bed. And, Don, I don't want to go downtown this late—"

"You don't have to. A camera crew is on its way here."

"Really? My God!"

"It pays to know the right people," he said with a grin.

"I—um, well, I look a mess . . ."

"You look *gorgeous*."

"Besides, who the hell is watching TV at this hour?"

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"Shut-ins, insomniacs, people channel-flipping looking for nudity—"

"Dad!" Emily had her little hands planted on her hips.

"—but they'll keep repeating the report, and it'll be picked up all over the world, I'm sure."

"We'd been so *wrong,"* Sarah told Shelagh Rogers the next morning. Don wasn't the Toronto sound engineer for *Sounds Like Canada*—Joe Mahoney was doing that these days—but Don stood behind Joe as he operated the board, looking over Joe's shoulder at Sarah.

And, while doing so, he reflected on the irony. Sarah was in Toronto, but Shelagh was in Vancouver, where Radio One's signature program originated—two people who couldn't see each other, communicating over vast distances by radio. It was *perfect.*

"Wrong in what way?" Shelagh's voice was rich and velvety, yet full of enthusiasm, an intoxicating combination.

"In *every* way," Sarah said. "In everything we'd assumed about SETI. What a ridiculous notion, that beings would send messages across the light-years to talk about *math!"* She shook her head, her brown hair bouncing as she did so. "Math and physics are the same everywhere in the universe. There's no need to contact an alien race to find out if they agree that one plus three equals four, that seven is a prime number, that the value of *pi* is 3.14159, *et cetera.* None of those things are matters of local circumstance, or of opinion. No, the things worth discussing are moral issues—things that are debatable, things that an alien race might have a radically different perspective on."

"And that's what the message from Sigma Draconis is about?" prodded Shelagh.

"Exactly! Ethics, morality—the big questions. And that's the other thing, the other way in which we were totally wrong about what to expect from SETI. Carl Sagan used to talk about us receiving an *Encyclopaedia Galactica.* But no one would bother sending a message across the light-years to *tell* you things. Rather, they'd send a message to *ask* you things."

"And so this message from the stars is . . . what? A questionnaire?"

"Yes, that's right. A series of questions, most of which are multiple choice, laid out like a three-dimensional spreadsheet, with space for a thousand different people to provide their answers to each question. The aliens clearly want a cross-section of our views, and they went to great pains to establish a vocabulary for conveying value judgments and dealing with matters of opinion, with sliding scales for precisely quantifying responses."

"How many questions are there?"

"Eighty-four," said Sarah. "And they're all over the map."

"For instance?"

Sarah took a sip from the bottle of water she'd been provided with. "'Is it acceptable to prevent pregnancy when the population is low?' 'Is it acceptable to terminate pregnancy when the population is high?' 'Is it all right for the state to execute bad people?'"

"Birth control, abortion, capital punishment," said Shelagh, sounding amazed. "I guess those are posers even for extraterrestrials."

"So it seems," said Sarah. "And there are lots more, all in one way or another about ethics and acceptable behavior. 'Should systems be set up to thwart cheaters at all costs?' 'If an identifiable population is disproportionately bad, is it permissible to restrict the entire population?' These are just preliminary translations, of course. I'm sure there'll be a lot of quibbling over the exact meaning of some of them."

"I'm sure there will be," said Shelagh, affably.

"But I wonder if the aliens aren't a bit naïve, at least by our standards," said Sarah. "I mean, basically, we're a race of

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hypocrites. We believe societal norms should be followed by others, and that there are always good reasons for ourselves to be exempt. So, yeah, asking about our morals is interesting, but if they actually expect our espoused beliefs to have any strong relationship to our actual behavior, they could be in for a big surprise. The fact that we even need a platitude 'practice what you preach' underscores just how natural it is for us to do exactly the opposite."

Shelagh made her trademark throaty laugh. "Do as I say, not as I do."

"Exactly," said Sarah. "Still, it's amazing, really, the sociological concepts the aliens were able to get to from talking about math. For instance, building on some discussion of set theory, several of their questions deal with in-groups and out-groups. William Sumner, who coined the term 'ethnocentrism,' noted that what he called 'primitive peoples' had very different ideas about morality for in-group versus out-group members. The aliens seem to want to know if we've risen above that."

"I'd like to think we have," said Shelagh.

"For sure," agreed Sarah. "One might also expect them to wonder whether we'd outgrown religion." She looked through the glass at Don. "The vocabulary the Dracons established certainly would have made it possible to formulate questions about whether we believed an intelligence existed outside the universe—essentially, whether a God exists. They could have also asked if we believed any information persisted after death—in other words, whether souls exist. But they didn't ask those things. My husband and I were arguing about that on the way down here this morning. He said the reason they didn't ask about religious matters is obvious: no advanced race could still be caught up in such superstitious beliefs. But maybe it's just the opposite. Maybe it's so blindingly obvious to the aliens that God exists that it never even occurred to them to ask us if we'd failed to notice him."

"Fascinating," said Shelagh. "But why, do you think, do the aliens want to know all this?"

Sarah took a deep breath, and let it out slowly—causing Don to briefly cringe at the dead air. But, at last, she spoke. "That's a very good question."

Chapter 15

Like most astronomers, Sarah fondly remembered the movie *Contact,* based on Carl Sagan's novel of the same name. Indeed, she argued it was one of the few cases where the movie was actually better than the over-long book. She hadn't seen it for decades, but a reference to it in one of the news stories about the attempts to decrypt the response from Sigma Draconis had brought it to mind. With pleasant anticipation, she sat down next to Don on the couch to watch it on Wednesday night. Slowly but surely she was getting used to his newly youthful appearance, but one of the reasons she felt like watching a movie was that she'd be doing something with Don in which they'd be sitting side by side and not really looking at each other.

Jodie Foster did a great job portraying a passionate scientist, but Sarah found herself smiling in amusement when Foster said, "There are 400 billion stars out there, just in our galaxy alone," which was true. But then she went on to say, "If only one out of a million of those had planets, and if just one out of a million of those had life, and if just one out of a million of those had intelligent life, there would be literally millions of civilizations out there." Nope, a million-million-millionth of 400 billion is so close to zero as to practically *be* zero.

Sarah looked at Don to see if he'd caught it, but he gave no sign. She knew he didn't like being interrupted by asides during movies—you couldn't memorize trivia the way he did if you weren't able to concentrate—and so she let the screenwriter's minor flub pass. And, besides, despite its inaccuracy, what Foster had said rang true, in a way.

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For decades, people had been plugging numbers made up out of whole cloth into the Drake equation, which purported to estimate how many intelligent civilizations existed in the galaxy. Foster's wildly inaccurate figure, pulled out of the air, was actually quite typical of these debates.

But Sarah's amusement soon turned to downright cringing. Foster went to see a large corporation to get funding for SETI, and, when it initially turned her down, she went ballistic, exclaiming that contacting an extraterrestrial civilization would be the biggest moment in human history, more significant than anything anyone had ever done or could possibly imagine doing, a species-altering moment that would be worth any cost to attain.

Sarah cringed because she remembered giving such patently ridiculous speeches herself. Granted, the detection of the original signal from Sigma Draconis had been page-one news. But until the second message had been received, it had been over thirty years since a mention of aliens had appeared on the front page or main screen of any newspaper that didn't have the words "National" and "Enquirer" in its title.

It wasn't just SETI researchers who had overhyped the impact of such things. Sarah had forgotten that then-president Bill Clinton appeared in *Contact,* but there he was, talking about how this breakthrough was going to change the world. Unlike the cameos by Jay Leno and Larry King, though, which had been specifically staged for the movie, she immediately recognized the Clinton speech as archival footage—not about the detection of alien radio messages, but about the unveiling of ALH84001, the Martian meteorite that supposedly contained microscopic fossils. But despite the presidential hyperbole, that hunk of rock hadn't changed the world, and, indeed, when it was ultimately discredited several years later, there was almost no press coverage, not because the story was being buried, but rather because no one in the public even really cared. The existence of alien life was a curiosity to most people, nothing more. It didn't change the way they treated their spouses and kids; it didn't make stocks rise or fall; it just didn't matter. Earth went on spinning, unperturbed, and its denizens continued to make love, and war, with the same frequency.

As the film continued, Sarah found herself getting increasingly pissed off. The movie had its extraterrestrials beaming blueprints to Earth so humans could build a ship that could tunnel through hyperspace, taking Jodie Foster off to meet the aliens face to face. SETI, the movie hinted, wasn't really about radio communication with the stars. Rather, like every other cheapjack Hollywood space opera, it was just a stepping stone to *actually going to other worlds.* From the beginning with Jodie Foster's cockeyed math, through the middle with the stirring speeches about how this would completely transform humanity, to the end with the totally baseless promise that SETI would lead to ways to travel across the galaxy and maybe even reunite us with dead loved ones, *Contact* portrayed the hype, not the reality. If Frank Capra had made a propaganda series called "Why We Listen," *Contact* could have been the first installment.

As the credits started to roll, Sarah looked at Don. "What did you think?" she asked.

"It's a bit dated," he said. But then he lifted his hands from his lap, as if to forestall an objection. "Not that there's anything wrong with that, but . . ."

But he was right, she thought. Things are of their times; you can't plug something meant for one era into another. "What ever happened to Jodie Foster, anyway?" she asked. "I mean, is she still alive?"

"She might be, I guess. She's about your . . ." He trailed off, but it had been obvious what he was going to say:

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"She's about your age." Not "about *our* age." Although he still saw her as an eighty-seven-year-old, it seemed he was now in full denial about the chronological facts that applied to himself—and that was driving Sarah up the walls.

"I always liked her," she said. When *Contact* had come out, the American press had said that Ellie Arroway, Jodie Foster's character, was based on Jill Tarter, and the Canadian papers had tried to spin it that Sarah Halifax had been the inspiration. And although it was true enough that Sarah had known Sagan back then, the comparison was a stretch. Why the press refused to believe that characters were just made up was beyond her. She remembered all the theories about who the paleontologists in *Jurassic Park* were based on; every woman who had taken even one paleo course was reputed to be the model for the Laura Dern character.

"You know what movie Jodie Foster is really good in?" Sarah said.

Don looked at her.

"It's um—oh, you know the one. It was one of my favorites."

"I need another clue," he said, a bit sharply.

"Oh, you know! We bought it on VHS, and then DVD, and then downloaded it in HD. Now, why can't I think of the title? It's on the tip of my tongue . . ."

"Yes? Yes?"

Sarah winced. Don was becoming more and more impatient with her as time went on. When he'd been slow, too, he hadn't seemed to mind her slowness as much, but now they were out-of-synch, like the twins in that film she used to show her undergrads about relativity. She thought about snapping that she couldn't help being old, but, then again, *he* couldn't help that he was young. Still, his impatience made her nervous, and that made it even harder for her to dredge up the title she was looking for.

"Um," she said, "it had that guy in it, too . . ."

"Maverick?" snapped Don. *"The Silence of the Lambs?"*

"No, no. You know, the one about the—" Why wasn't the term coming to her?—"the, the . . . the child prodigy."

"Little Man Tate," Don said at once.

"Right," said Sarah, very softly, looking away.

Chapter 16

Don moved over to the La-Z-Boy after Sarah had gone to bed, and sat glumly in it. He knew he'd made her feel bad earlier, when she'd been trying to remember the title of that movie, and he hated himself for it. Why had he been patient when his days were numbered, but impatient now that he had so much time? He'd tried not to snap at Sarah, he really had. But he just couldn't help himself. She was so *old*, and—

The phone rang. He glanced at the call display, and felt his eyebrows going up: "Trenholm, Randell." It was a name he hadn't thought about for thirty years or more, a guy he'd known at the CBC back in the Twenty-Teens. Ever since the rollback had gone bad for Sarah, Don had been avoiding seeing people he knew—and now he was doubly glad they didn't have picture phones.

Randy was a couple of years older than Don was, and, as he picked up the handset, it occurred to him that it might be Randy's wife calling. So often these last few years, calls from old friends were really calls from their surviving spouses with word that the friend had passed on.

"Hello?" said Don.

"Don Halifax, you old son of a gun!"

"Randy Trenholm! How the hell are you?"

"How is anyone when they're eighty-nine?" Randy asked. "I'm alive."

"Glad to hear it," Don said. He wanted to ask about Randy's wife, but couldn't remember her name. "What's up?"

"You're in the news a lot lately," Randy said.

"You mean Sarah is," said Don.

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"No, no. Not Sarah. You, at least in the newsgroups I read."

"And, um, what groups are those?"

"Betterhumans. Immortality. I Do Go On."

He knew gossip about what had happened to him had to have spread further than just the block he lived on. But, "Yeah, well," is all he said in reply.

"So Don Halifax is rubbing shoulders with the movers and shakers," said Randy. "Cody McGavin. Pretty impressive."

"I only met him once."

"Guy must have written you a pretty big check," Randy said.

Don was feeling more and more uncomfortable. "Nah," he said. "I never saw the bill for the procedure."

"Didn't know you were interested in life prolongation," Randy said.

"I'm not."

"But you got it."

"Randy, look, it's getting late. Is there something I can help you with?"

"It's just that, like I said, you know Cody McGavin—"

"Not really."

"And so I thought maybe you could have a word with him, you know, on my behalf."

"Randy, I don't—"

"I mean, I've got a lot to offer, Don. And a lot of things still to do, but—"

"Randy, honestly, I—"

"Come on, Don. It's not like you're special. But he paid for your rollback."

"It was Sarah he wanted to have rollback, and—"

"Oh, I know, but it didn't work for her, right? That's what they say, anyway. And, look, Don, I'm really sorry about that. I've always liked Sarah."

Randy apparently expected a response, as if having made this obeisance he was now due something in return. But Don remained quiet. After the silence had grown to an uncomfortable length, Randy spoke again. "So, anyway, he did it for you, and—"

"And you think he'll do it for you, too? Randy, I honestly don't know how much all the work I had done cost, but—"

"They estimate eight billion on Betterhumans. Most people on I Do Go On think it's more like ten."

"But," continued Don, firmly, "I didn't ask for it, and I didn't want it, and—"

"And that's pocket change to the likes of Cody McGavin."

"I don't think that's pocket change to *anybody,"* said Don, "but that's beside the point. He can spend his money any way he likes."

"Sure, but now that he's doling it out to let some of those who aren't insanely rich have a rollback, well, I thought, you know, maybe . . ."

"There's nothing I can do for you. I'm sorry, but—"

The voice was getting more desperate. "Please, Don. I've still got a lot to contribute. If I had a rollback, I could . . ."

"What?" asked Don, his tone sharp. "Cure cancer? It's been done. Invent a better mousetrap? Gene-splicers will just make a better mouse."

"No, important things. I'm—you don't know what I've done in the last twenty years, Don. I've—I've done things. But there's a lot more I want to accomplish. I just need more time, is all."

"I'm sorry, Randy. Really, I am—"

"If you'd just *call* McGavin, Don. That's all I'm asking. Just make one phone call."

He thought about snapping that it had taken forever to get through to McGavin the last time, but that was none of Randy's business. "I'm sorry, Randy," he said again.

"Damn it, what did you do to deserve this? You're not that special. You're not that bright, that talented. You just fucking won the lottery, is all, and now you won't even help me buy a ticket."

"For Christ's sake, Randy . . ."

"It's not fair. You said it yourself. You aren't even interested in transhumanism, in life extension. But me, I've spent

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most of my life pursuing that. 'Live long enough to live forever'—that's what Kurzweil said. Just hold on for a few more decades, and we'll have rejuvenation techniques, we'll have practical immortality. Well, I *did* hold on, and it's here, the techniques are here. But I can't afford them."

"They'll come down—"

"Don't fucking tell me they'll come down in price. I *know* they'll come down in price. But not in time, damn it. I'm eighty-nine! If you'd just call McGavin, just pull a couple of strings. That's all I'm asking—for old time's sake."

"I'm sorry," Don said. "I really am."

"Damn you, Halifax! You've got to do this. I—I'm going to die. I'm going—"

Don slammed the handset down, and sat quaking in his chair. He thought about going upstairs to see Sarah, but she couldn't understand what he was going through any more than Randy Trenholm did; he so wished he had someone to talk to. Of course, there were other people who had undergone rollbacks, but they were totally out of his league—the financial gulf separating him from them was so much greater than their shared experience of rejuvenation.

A while later, he headed upstairs, and went through the motions of getting ready for bed, and, at last, he lay down, next to Sarah, who had already turned in, and he stared at the ceiling—something he found himself doing more and more these days.

Randy Trenholm was right, in a way. Some people probably should be kept around. The last of the twelve men who had walked on the moon had died in 2028. The greatest thing the human race had ever done had happened in Don's lifetime, but no one who had actually ever set foot upon the lunar surface was still alive. All that was left were photos and videos and rocks and a scant few poetic descriptions, including Aldrin's "magnificent desolation." People kept saying it was inevitable that humans would someday return to the moon. Perhaps, thought Don, he might now live to see that, but, until they did, the actual experience of those small steps, those giant leaps, had passed from living memory.

And, even more tragic, the last survivor of the Nazi death camps—the final witness to those atrocities—had died in 2037; the worst thing humanity had ever done had also passed out of living memory.

Both the moon landing and the Holocaust had their deniers: people who claimed that such wonder, and such horror, never could have happened, that humans were incapable of such technological triumphs, or of such conscienceless evil. And now, every last one of those who could gainsay that from personal experience was gone.

But Donald Halifax lived on, with nothing special to attest to, no important experience to which he alone bore witness, nothing that needed to be shared with future generations. He was just some guy.

Sarah stirred in her sleep next to him, rolling onto her side. He looked over at her in the darkness, at the woman who had done what no one else had ever done: figured out what an alien radio message meant. And, if Cody McGavin was right, she was the best bet to do it again. But she'd be gone all too soon, while he would go on. If the rollback were only going to work for one of them, it should have been *her,* Don knew. She mattered; he didn't.

He shook his head, his hair rustling against the pillow. He knew logically that he hadn't taken the rejuvenation away from Sarah, that its success with him had nothing to do with its failure for her. And yet the guilt was oppressive, like the weight of six feet of earth pressing down upon him.

"I'm sorry," he whispered into the dark, facing the ceiling again.

"For what?" Sarah's voice startled him.

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He hadn't realized she was awake, but now that he turned his head to face her, he could see little reflections of the dim outside lights in her open eyes.

He scooched closer to his wife and gently hugged her to him. He thought about letting the words he'd spoken apply only to his having been short with her earlier that evening, but there was more—so much more. "I'm sorry," he said at last, "that the rollback worked on me but not on you."

He felt her expand in his embrace as she took a deep breath, then contract again as she let it out slowly. "If it could only have worked on one of us," said Sarah, "I'm glad it was you."

He hadn't been expecting that at all. "Why?"

"Because," she said, "you're such a good man."

He could think of no reply, and so he just held her. Eventually, her breathing grew regular and noisy. He lay there for hours, listening to it.

Chapter 17

It was time, Don knew, that he got a job. Not that he and Sarah were desperate for money; they both had pensions from their employers and the Federal government. But he needed to do *something* with all the energy he now had, and, besides, a job would probably help get him out of his deepening funk. Despite the physical wonders of being young again, it was all weighing heavily on him—the difficulty in relating to Sarah, the jealousy of old friends, the endless hours he spent staring into space while wishing things had turned out differently.

And so he walked over to North York Centre station, just a couple of blocks from their house, and got on the subway at the station located beneath the library tower there. It was a hot August day, and he couldn't help noticing the scantily clad young women aboard the train—all of them healthy-looking, tanned, and lovely. Watching them made the trip go quickly, although he was stunned, and a bit embarrassed, to note that a girl who got off at Wellesley had in fact been looking at him with what seemed to be admiration.

When he reached his own stop—Union Station—he got out and walked the short distance to the CBC Broadcast Centre, a giant Borg cube of a building.

He knew this place like—well, not like the back of his hand; he was still getting used to that appendage's new, smooth, liver-spot-free appearance. But he no longer had an employee's passcard, and so had to wait for someone to come and escort him up from the Front Street security desk. While he waited, he looked at the full-size holograms of current CBC Radio personalities. Back in his day, they'd been a collection of cardboard standees. None of the faces were familiar to him, although he recognized most of the names.

"Donald Halifax?" Don turned and saw a slight Asian man in his mid-thirties, with incongruous peach-colored hair. "I'm Ben Chou."

"Thank you for agreeing to see me," Don said, as Ben got him through the gate.

"Not at all, not at all," said Ben. "You're a bit of a legend around here."

He felt his eyebrows go up. "Really?"

They entered an elevator. "The only audio engineer John Pellatt would work with? Oh, yes indeed."

They left the elevator, and Ben led them into a cramped office. "Anyway," he said, "I'm glad you came down. It's a pleasure to meet you. But I don't get what you're doing applying for a job. I mean, if you can afford a rollback, you hardly need to work here." He looked around the windowless office. It happened that they were on the fifth floor, and so should have been able to see Lake Ontario, but no matter where you were in this building, it felt subterranean.

"I can't afford a rollback," he said, taking the seat Ben was gesturing at.

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"Oh, yeah, well, your wife . . ."

He narrowed his eyes. "What about her?"

Ben looked cornered. "Um, isn't she rich? She decoded that first message, after all."

"No, she's not rich, either." Perhaps she could have been, he thought, if she'd struck the right book deal at the right time, or had charged for all the public lectures she'd given in the first few months after the original message had been received. But that was water under the bridge; you don't get a second chance at *everything.*

"Oh, well, I—"

"So I need a job," Don said. Interrupting his potential boss probably wasn't a strategy a career counselor would have approved of, he thought, but he couldn't take this.

"Ah," said Ben. He looked down at the flatsie reader on his desktop. "Well, you did Radio and Television Arts at Ryerson. Good man; so did I." Ben squinted a bit. "Class of 1982." He shook his head. "I was class of 2035."

The point was obvious, so Don tried to deflect it by making light of it. "I wonder if we had any of the same instructors?"

To his credit, Ben snorted a laugh. "And how long did you work here at the CBC?"

"Thirty-six years," said Don. "I was a recording-engineer/producer when I . . ."

He backed away from saying the word, but Ben provided it, underscored by a crisp nod of his head: "Retired."

"But," continued Don, "as you can see, I'm young again, and I want to go back to work."

"And what year did you retire?"

It was right in front of him, Don knew, on his resumé, but the bastard was going to force him to say it aloud. "Twenty Twenty-Two."

Ben shook his head slightly. "Wow. Who was prime minister back then?"

"Anyway," said Don, ignoring the remark, "I need a job, and, well, once the Mother Corp is in your blood . . ."

Ben nodded. "Ever worked on a Mennenga 9600?"

Don shook his head.

"An Evoterra C-49? Those are what we use now."

He shook his head again.

"What about editing?"

"Sure. Thousands of hours"—at least half of which had been cutting physical audio tape with razor blades.

"But on what sort of equipment?"

"Studer. Neve Capricorn. Euphonix." He deliberately left off model numbers, and he also refrained from mentioning Kadosura, which had been out of business for twenty years now.

"Still," said Ben, "the equipment keeps changing all the time."

"I understand that. But the principles—"

"The principles change, too. You know that. We don't edit the same way we did a decade ago, let alone *five* decades ago. The style and pace are different, the *sound* is different." He shook his head. "I wish I could help you, Don. Anything for a fellow Ryerson man—you know that. But . . ." He spread his arms. "Even a guy fresh out of school knows the stuff better than you do. Hell, he knows it better than *I* do."

"But I don't have to be hands-on," said Don. "I mean, the last while, I wasn't much, anyway. I was mostly doing management, and that doesn't change."

"You're exactly right," Ben said. "It doesn't change. Meaning a guy who looks twenty-something isn't going to be able to command respect from men and women in their fifties. Plus, I need managers who know when an engineer is bullshitting them about what the equipment can and can't do."

"Isn't there *anything?*" Don asked.

"Have you tried downstairs?"

Don drew his eyebrows together. "In the lobby?" The lobby—the Barbara Frum Atrium, as it was technically known, and Don was old enough to have actually worked with Barb—con-

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tained nothing much except a couple of restaurants, the three security desks, and lots of open space.

Ben nodded.

"The lobby!" Don exploded. "I don't want to be a fucking security guard."

Ben raised his hands, palm out. "No, no. That's not what I meant. I meant—don't take this the wrong way, but what I meant was the museum."

Don felt his jaw go slack; Ben might as well have punched him in the gut. He'd all but forgotten about it, but, yes, in the lobby there was a small museum devoted to the history of the CBC.

"I'm not a bloody *exhibit,*" Don said.

"No, no—no! That's not what I meant, either. I just meant that, you know, maybe you could join the curatorial staff. I mean, you know so much of that stuff first hand. Not just Pellatt, but Peter Gzowski, Sook-Yin Lee, Bob McDonald, all those guys. You knew them and worked with them. And it says here you worked on *As It Happens* and *Faster Than Light.*"

Ben was trying to be kind, Don knew, but it really was too much. "I don't want to live in the past," he said. "I want to be part of the present."

Ben looked at the wall clock, one of those broadcasting units with red LED digits in the middle encircled by sixty points of light that illuminated in sequence to mark passing seconds. "Look," he said, "I've got to get back to work. Thanks for dropping by." And he got up and extended his hand. Whether Ben's shake was normally limp and weak, or whether he was being delicate because he knew he was shaking an eighty-seven-year-old's hand, Don couldn't say.

Chapter 18

Don returned to the lobby. It said something nice about Canada that anyone could walk around the vast Barbara Frum Atrium, looking up at the six floors of indoor balconies, and watch while all sorts of CBC personalities—the Corporation frowned on the use of the word "stars"—came and went, unaccompanied by security guards or handlers. The little restaurant Ooh La La!, which had been there forever, had tables spilling out into the atrium, and there was one of *Newsworld's* anchors enjoying a Greek salad; at the next table, the lead performer in a children's show Don had watched with his granddaughter was sipping coffee; crossing over to the elevators was the woman who currently hosted *Ideas.* All very open, all very welcoming—of everyone, except him.

The broadcasting museum was tiny, and tucked off to one side, clearly an afterthought in designing the building. Some of the stuff predated Don. The kiddie program *Uncle Chichimus* was before his time, and *This Hour Has Seven Days* and *Front Page Challenge* were shows his parents had watched. He *was* old enough to remember *Wayne and Shuster,* but not old enough to have ever thought they were funny. But he'd learned his first French from *Chez Hélène,* and had spent many happy hours with *Mr. Dressup* and *The Friendly Giant.* Don took a minute to look at the model of Friendly's castle, and the puppets of Rusty the Rooster and Jerome the Giraffe. He read the placard that explained that Jerome's bizarre color scheme of purple and orange had been selected in the days of black-and-white TV because it had good contrast, and had been left intact when the program switched to color in 1966, giving him a psychedelic look, an unintentional reflection of the times.

Don had forgotten that Mister Rogers had gotten his start here, but there it was, the original miniature trolley from that show, back when it had been called *Mister Rogers' Neighbourhood*, the last word notably sporting a *U.*

No one else was in the museum just now. The emptiness of the handful of rooms was a testament to the fact that people didn't care about the past.

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Monitors were showing clips from old CBC shows, some of which he remembered, much of which was cringe-worthy. In the vaults here there must be tapes of dreadful stuff like *King of Kensington* and *Rocket Robin Hood*. Perhaps some things *should* be allowed to pass out of living memory; perhaps some things should be ephemeral.

There was some old radio and television hardware on display, including machines he himself had used early in his career. He shook his head. He shouldn't be curator of a museum like this. He should be on display, a relic of a bygone age.

Of course, he didn't look like a relic—and the Canadian National Exhibition no longer had a freak show; he could just barely remember visiting the Ex as a child and hearing the barkers call out descriptions of fish-tailed men and bearded ladies.

He left the museum, and left the building, going out the Front Street entrance. There were other broadcasters in town, but he doubted he'd have better luck with them. And, besides, he liked working on radio drama and audio documentaries of the kind nobody but the CBC made anymore; as far as other broadcasters would be concerned, his CV might as well have said he painted cave walls at Lascaux.

Don had arrived at the entrance to Union Station, which was at the bottom of the U comprising the oldest part of the subway system. He headed downstairs and passed through the turnstile, paying the normal adult—rather than senior citizen's—fare, and then took the escalator down to the platform. He stood beneath one of those digital clocks that hung from the ceiling. A train came rushing in, and he felt his hair whipping because of its passage, and—

—and he was transfixed, unable to move. The doors opened, making their mechanical drumroll sound, and people jostled in and out. Then the three descending tones sounded, indicating that the doors were closing, and the train started moving again. He found himself stepping right up to the edge of the platform, looking at its departing back.

A little boy, no more than five or six, was staring out the rear window at him. Don remembered when he used to like sitting in the front car as a kid, watching the tunnel speed by; the rear car, looking back, was almost as good. There was a grinding sound as the train banked, turning to go north, and then it was gone. He looked down onto the tracks, maybe four feet below, his toes sticking over the platform's edge. He saw a gray mouse scuttle by, and he saw the third rail, and the notices, covered with grime, that warned of the electrocution danger.

Soon enough, another train was coming down the curving track; its headlights cast mad shadows in the tunnel before it became visible. Don felt the vibration of the train, inches from his face, as it zoomed past him, felt his hair whipping again.

The train stopped. He looked into the window facing him. Most riders got out at Union, although a few people always rode the train around the bend.

Around the bend.

This *was* the time-honored method to do this, wasn't it? Here, in Toronto, it was the way the despondent had handled things since before he'd been born. The subway trains roared into the station at high speed. If you waited at the right end of the platform, you could jump in front of an incoming one, and—

And that would be it.

Of course, it wouldn't be fair to the train's operator. Don remembered reading years ago, in the *Star*, about how devastating it was for subway drivers when people killed themselves this way. The drivers often had to go on extended leave, and some were so afraid that the same thing would happen again they were never able to return to their jobs. Stations in the downtown core were

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forty-five seconds apart; there wasn't even time for the drivers to relax between them.

But that had been back when the trains had had human drivers. These days, they were operated by sleek mechanicals, courtesy of McGavin Robotics.

The irony was tempting, and—

And he was trembling from head to toe. Suddenly, his body sprang into action, moving as fast as it could, and—

—and he just barely squeezed through the doors before they rumbled shut. Don clung tightly onto a metal pole for the whole trip home, like a drowning man grasping a log.

Chapter 19

Back in 2009, Sarah had spent at least as much time discussing the Dracon questionnaire as she did teaching astronomy, and the topic often spilled over into evening conversations with Don. One night, when Carl was down in the basement playing *The Sims 4,* and ten-year-old Emily was at her Girl Guides meeting, Sarah said, "Here's an ethical dilemma that came up on the SETI newsgroup today. Some of the SETI researchers think they know what the aliens are trying to determine with their survey, which means we could give them the answers they want, in hopes that they'll keep up contact with us. So, should we lie to get what *we* want? That is, just how unethical is it to cheat on a survey about ethics?"

"The Dracons are probably at least as clever as we are, no?" Don had said. "So wouldn't they see through any attempt at deception?"

"That's what I said!" Sarah replied, sounding pleased to be vindicated. "The instructions for the questionnaire make it quite clear that the thousand responses we send should be produced independently and in private. They say there may be follow-up questions, and any consultation among participants will ruin those. And I suspect they've actually got some sort of way of determining if the answers are all from one person, instead of the thousand individuals they'd asked for, or are from a group that collaborated—you know, by some sort of statistical analysis of the answers."

They were doing general cleaning up. With both of them working during the days, housework ended up being a low priority. Don was dusting the mantel. "You know what I'd like?" he said absently, looking at the framed Emily Carr print on the wall there. "One of those big sixty-inch flatscreen TVs. Don't you think it'd look great right here? I know they cost a fortune right now, but I'm sure they'll come down in price."

Sarah was gathering up sections of newspaper. "You should live so long."

"Anyway," he continued, "you were saying about the Dracon questionnaire?"

"Yeah. Even if we did want to fake it and have a committee draw up all the answers, for some of the questions we honestly don't know what the 'right' answer is."

He moved on to picking up the used mugs from the coffee table. "Like what?"

"Well, like question thirty-one. You and another person jointly find an object that has no apparent worth, and neither of you desire it. Which of you should keep it?"

Don stopped to ponder, two yellow mugs in his right hand, and one in his left; at sixteen, Carl was learning to drink coffee. "Umm, I don't know. I mean, it doesn't matter, does it?"

Sarah had finished gathering newspapers, and nipped into the kitchen to dump them in the blue box. "Who knows?" she called out. "There's obviously *some* moral point here that the aliens are getting at, but no one I've spoken to can see what it is."

He followed her in, rinsed the mugs under the faucet, and then put them in the dishwasher. "Maybe neither of you should take the object. You know, just leave it where you found it."

She nodded. "That would be good, but that's not one of the allowed an-

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swers. The survey is mostly multiple choice, remember."

He was loading a few plates into the dishwasher. "Heck, I don't know. Um, the other guy should take it—'cause, um, 'cause that's me being generous, see?"

"But he doesn't want it," she said.

"But it might turn out to be valuable someday."

"Or it might turn out to be poisonous, or to belong to somebody else who'll be angry over it being taken, and who will exact revenge from whoever stole it."

He shook his head, and put an Electrasol tab into the detergent cup. "There just isn't enough information."

"The aliens think there is, apparently."

He started the dishwasher, and motioned for Sarah to follow him out of the room; the machine was noisy. "Okay," he said, "so you *can't* just give the Dracons the answers that'll make us look good, because you don't know what those are in all cases."

"Right," said Sarah. "And, anyway, even for those questions we *do* understand, there's debate about which answers *would* make us look good. See, some of our morals are rational, and others are based in emotion—and it's not clear which ones the aliens would prize most."

"I thought all morals were rational," Don said. He looked around the living room, gauging if anything else needed tending to. "Isn't that the definition of morality: a rational, reasoned response, instead of a knee-jerk, visceral one?"

"Oh?" she said, straightening the pile of current magazines—*Maclean's, Mix, Discover, The Atlantic Monthly*—that lived on the little table between the couch and the La-Z-Boy. "Try this one on for size. It's a standard puzzle in moral philosophy, a little number called 'the trolley problem.' It's called that because a British philosopher came up with it. Her name, by the way, was Philippa Foot—two fetishes in one, if you stop to think about it. Anyway, she said this: say a streetcar is out of control, rushing along its tracks. And say there are five people stuck on those tracks, unable to get away in time—if the train hits, it'll kill them all. But you happen to be watching all this from a bridge over the tracks, and on the bridge are the switching controls, including a lever that if you pull it will cause the streetcar to be diverted to another track, off to the left, missing the five people. What do you do?"

"Pull the lever, of course," he said. Deciding there was nothing else that needed doing tonight, he sat down on the couch.

"That's what almost everyone says," Sarah said, joining him. "Most people feel a moral obligation to intervene in situations where human life is at risk. Oh, but I forgot to tell you one thing. There's a really big guy stuck on that *other* track. If you divert the streetcar, he'll be killed. Now what do you do?"

He put his arm around her. "Well, um, I'd—I guess I'd still pull the lever."

She leaned her head against his shoulder. "That's what most people say. Why?"

"Because only one person dies rather than five."

He could hear in her voice that she was smiling. "A Trekker to the core. 'The needs of the many outweigh the needs of the few.' No wonder that's what Mr. Spock believes; it's clearly the product of rational thinking. Now, what about this? Say there's no second track. And say instead of being the one hapless fellow stuck on the left, the big guy isn't stuck at all. Instead he's standing right next to you on the bridge. You know for a fact that if you push him off so that he falls in front of the streetcar, hitting him will be enough to make it stop before it hits the five other people. But you yourself are a little guy. The streetcar wouldn't be stopped by hitting you, so there's no point in jumping yourself, but it'll definitely be stopped by hitting this big fellow. Now what do you do?"

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"Nothing."

Don could feel her head nodding. "Again, that's what most people say—they wouldn't do a thing. But why not?"

"Because, um, because it's wrong to . . . well, ah . . ." He frowned, opened his mouth to try again, but then closed it.

"See?" said Sarah. "They're comparable situations. In both scenarios you choose to have one guy die—the same guy, in fact—to save five others. But in the first, you do it by throwing a lever. In the second, you actually push the guy to his death. The rational equation is exactly the same. But the second scenario *feels* different emotionally. For most people, what was judged right in the first scenario is judged wrong in the second." She paused. "The aliens didn't ask that specific question about the streetcar, but there are others for which there's an emotionally ethical response and a logically ethical response. As to which one the Dracons would prefer to see, I'm not sure."

Don frowned again. "But wouldn't advanced beings naturally prefer logic to emotion?"

"Not necessarily. Fairness and a desire for reciprocity seem to be emotional responses: they occur in animals who obviously aren't reasoning in an abstract, symbolic way, and yet those are some of the things we prize most. The aliens might prize them, too, meaning the emotional answers might in fact be what they're looking for. Still, some of my colleagues *do* argue that the logical answers are the better ones, because they denote more sophisticated cognition. And yet giving the purely logical answers wouldn't really portray who we are. I mean, consider this, for instance—the aliens didn't ask about it, but it makes a good point. We've got two kids, a boy and a girl. Suppose when Emily's older, Carl and Emily both went away somewhere for a weekend, and decided to have sex with each other—just once, just to see what it was like."

"Sarah!"

"See, you're immediately disgusted. And, of course, so am I. But *why* are we disgusted? Well, presumably because evolution has bred into us a desire to promote exogamy and avoid the birth defects that often come out of incestuous unions. But say they were practicing birth control—you *know* any daughter of mine will be. That means the concern about birth defects isn't relevant. Plus, say that both were free of venereal disease. Say they only did it that once, and that it caused them no psychological harm at all, and they never told anyone else about it. Is it still disgusting? My gut—and I bet yours, too—says yes, even though we can't articulate a rational reason for the disgust."

"I suppose," he said.

"Right. But for an awfully long time, in a lot of places, homosexual unions were greeted with disgust, too, as were interracial ones. These days, most people don't react negatively to them at all. So, just because something disgusted people once doesn't mean it's universally wrong. Morals change, in part because people can be won over to new positions. It was mostly rational argument, after all, that made the women's rights and civil rights movements possible. People became convinced that slavery and discrimination were wrong on a principled basis; you educate people about an issue, and their view of what's moral changes. In fact, that's what happens with children. Their behavior gets more moral as their reasoning powers develop. They go from thinking something is wrong simply because they might get caught, to thinking something is wrong in principle. Well, maybe we're grown up enough for the Dracons to want to continue being in contact with us, and maybe we're not, and if we're not there's no way we can guess what the right answers are." Sarah snuggled against him. "No, in the end, I think the only thing we can do is exactly what they asked: send a thousand, independent sets of answers, each done in isola-

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tion, each one as honest and truthful as possible."

"And then?"

"And then wait for whatever reply they might eventually send."

Chapter 20

Another hot August day. Don had headed downtown again, but this time it wasn't for a job interview, and so he was actually wearing clothes appropriate for the weather: cut-off denim shorts and a light-blue T-shirt. He was grateful for them as he effortlessly climbed the stairs from the subway station, and exited out into the muggy, searing heat.

Sarah, along with the rest of the SETI community, was still trying to find the decryption key for the second message from Sigma Draconis, and last night an idea had occurred to her. But to try it, she needed some old paper records that were stored down at the University.

It was only a short walk from Queen's Park subway station to the McLennan Physical Laboratories tower, which housed the University of Toronto's Department of Astronomy and Astrophysics. On its roof were two observatory domes. Don remembered what he used to think when he saw them: that they couldn't possibly do any good, surrounded by the glare of downtown Toronto. But, to his surprise, as he glanced up at them now, he found himself thinking that they looked like a nice, firm pair of breasts.

As he came out of the elevator on the fourteenth floor of the tower, he saw that along one wall of the corridor there was a display about famous people who had been associated with the department. Included were Dr. Helen Sawyer Hogg, dead for fifty-five years now, whose weekly astronomy columns Don remembered reading as a boy in the Saturday *Star;* Ian Shelton, who discovered Supernova 1987a in the Large Magellanic Cloud; and Sarah herself. He paused and read the placard about Sarah, then looked at her photo, which must have been taken at least forty years ago; she hadn't worn her hair that long since.

Ah, well. Timeworn photos were appropriate here. Universities themselves were an anachronism, bucking the long-established trend to do everything online, everything by telecommuting. Hallowed halls, ivory towers—the synonyms his mental thesaurus provided just underscored how quaint and old-fashioned such institutions were. And yet, somehow, they endured.

He looked again at the photo of Sarah and found himself grinding his teeth. If things had gone the way they were supposed to, his wife would be even younger-looking now. This photo would be of what she'd have had to look forward to, when she gracefully entered middle age for a second time . . . around 2070, he supposed.

He headed around a bend in the corridor, the walls now lined with framed astronomical photos, until he found the door he was looking for. He knocked lightly on it. Old habits die hard, he realized; he'd long ago given up fervent rapping, since it used to hurt his arthritic knuckles, but now he wondered if anyone could have possibly heard him through the thick wood. He was about to knock again, and more loudly, when he heard a female voice call out, "Come in."

He entered, leaving the door open behind him. A young redhead, seated at a computer workstation, looked up at him expectantly.

"I'm looking for Lenore Darby," Don said.

She raised a hand. "Guilty."

He felt his eyebrows going up. Now that he saw her, he did remember that there'd been a redhead among the grad students at the last Christmas party, but he'd forgotten, or, more likely, had failed to notice then, just how pretty she was.

Lenore looked to be twenty-five—a real twenty-five, no doubt. Her orange hair cascaded down to her shoulders, and she had freckled white skin and

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bright green eyes. She was wearing green denim shorts and a white T-shirt that said "Onderdonk" on it, which, he guessed, was the name of a musical group. The shirt's lower half had been tied in a knot around her stomach, revealing a couple of inches of midriff that hadn't bunched at all even though she was sitting down.

"Can I help you?" she asked, smiling a perfect smile. So many of Don's contemporaries had spent their whole adult lives, as Don had until recently, with various dental imperfections—misalignments and gaps, overbites and underbites—but young people today almost always had *perfect* teeth, brightly white, totally straight, and completely free of cavities.

He steeled himself for giving the spiel, then: "I'm Don Halifax," he said. "I know I—"

"Oh, my goodness!" exclaimed Lenore. She looked him up and down, causing him to feel embarrassed and awkward, and probably even to blush. "I'd been expecting—well, he must be your grandfather. Are you named for him?"

She'd met an eighty-seven-year-old man back in December named Don Halifax, and she'd been told someone with that name was coming by to pick up some papers for Sarah, so . . .

So, yeah, it was a perfectly reasonable guess on her part. "That's right," he said. Indeed, what she'd suggested was in fact true, just not in the way she meant it. His full name was Donald Roscoe Halifax, and Roscoe had been his father's father's name.

So, why not? It was a harmless enough fiction, and he really hated having to explain his current situation; he certainly didn't want to go over the whole sorry mess with everyone he met. Besides, he'd probably never see this girl again.

"Nice to meet you!" said Lenore. "I've met your grandfather a couple of times. What a charming fellow!"

He was pleased by this assessment, and allowed himself a small smile. "That he is."

"And how is—" Don felt himself holding his breath. If she had finished her sentence with "your grandmother," he doubted he could have gone on with the charade, but she said, "And how is Professor Halifax?"

"She's fine."

"That's good," said Lenore, but then she surprised Don by shaking her head. "I sometimes wish I were older." She smiled and got up, tugging at the tied-up part of her T-shirt after she'd done so to get it to sit properly, which had the effect, for a moment, of emphasizing her breasts. "See, I could have had her as my thesis supervisor. Not that Professor Danylak isn't great, but, you know, it's frustrating studying where the most famous person in my chosen field actually worked and having almost no interaction with her."

"Your specialty is SETI, too?"

She nodded. "Yup. So, as you can imagine, Professor Halifax is a bit of a hero of mine."

"Ah," he said. He looked briefly around the room, because—

Because, he realized, he'd probably been looking too intently, too long, at the very attractive young woman. There were the usual fabric-covered room dividers, and one wall was lined by filing cabinets. The paperless office and the flying car had been a few years in the future for his entire life, but maybe, finally, he'd actually now live long enough to eventually see one or the other become a reality.

He opened his mouth to go on, but caught himself in time. He'd been about to say "Sarah asked me to . . . ," but who the hell calls his own grandmother by her first name? And yet he couldn't bring himself to actually say, "My grandmother." After a second, he fell back on the passive voice. "I've been asked to pick up some old files."

"Oh, I know," said Lenore. "I'm low

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person on the totem pole here; I'm the one who had to dig around for them down in the basement." She was about five foot four, although presumably never thought of herself that way; his generation had been the last Canadian one to be taught imperial measures in school. "Let me get them for you."

She walked across the room, and he found his eyes tracking the movement of her rear end through her shorts. Sitting on top of one of the filing cabinets was a stack almost a foot high of papers stuffed into several manila file folders.

Don was worried that his new looks didn't quite stand up to scrutiny; his own appearance these days was so startling to himself that part of him assumed it should be startling to others, too. But as she handed the great pile of paper to him, she gave no sign if she found anything out of the ordinary about him.

For his part, he found himself noticing the gentle hint of fruit fragrance—how wonderful to have his sense of smell back! It wasn't perfume. More likely, he thought, it was her shampoo or conditioner, and it was quite pleasant.

"My goodness," he said. "I didn't expect there to be so much!"

"Do you need a hand getting it all down to your car?" asked Lenore.

"Actually, I took the subway."

"Oh! I can get you a box to put it in."

"Thanks, but . . ." She lifted her orange eyebrows, and he went on. "It's just I was going to go the Art Gallery this afternoon. They've got a special exhibition on of Robyn Herrington blown glass that I want to see."

"Heck, the Art Galley is only a couple of blocks south of here. Why don't you leave the papers here, and pick them up when you're done?"

"I don't want to be a bother."

"Oh, it's no bother at all! I'll be here straight through until five o'clock."

"Workaholic, eh? You must really like it here."

She leaned her shapely rump against a nearby desk. "Oh, yes. It's terrific."

"You're doing a Ph.D.?"

"Not yet. I'm just finishing my Master's."

"Is this where you did your undergrad?"

"Nah. I went to Simon Fraser."

He nodded. "And is that where home is? Vancouver?"

"Yup. And, no offense, it sure beats this place. I miss the ocean, I miss the mountains, and I can't stand the climate here."

"But don't you get tired of all the rain in Vancouver?"

"I don't even notice it; it's what I'm used to. But the snow here in winter! And the humidity now. I'd die if it weren't for air-conditioning."

Don wasn't much of a fan of Toronto's climate either. He nodded again. "So, are you going to move back after you finish here?"

"Nah, probably not. I want to go somewhere in the southern hemisphere. Not nearly enough SETI searching has been done of the southern skies."

"Anywhere in particular?" asked Don.

"The University of Canterbury has a great astronomy department."

"Where's that?"

"New Zealand. Christchurch."

"Ah," said Don. "Mountains *and* the ocean."

She smiled. "Exactly."

"Have you ever been there?"

"No, no. But someday . . ."

"It's great."

"You've been?" she asked, letting her eyebrows climb her freckled brow.

"Yup," he said, adopting her style of speech. "Back in—" He stopped himself before he said, "Back in 1992." "Ah, a few years ago."

"Ooow," said Lenore, her lips puckering appealingly as she made the sound. "What was it like? Did you just love it?"

He thought he should break eye contact with the young woman again, and his gaze landed on a digital wall clock; it was 1:10. He was getting hungry. That

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was another thing that had come back along with his sense of smell, now that his body had renewed itself. For so long, he'd been eating tiny meals, always having leftovers to take home from restaurants, and during the rollback, while his body had been rebuilding lost muscle mass, he'd eaten like the proverbial pig. Now, though, his appetite had settled into being what it'd been when he really had been twenty-five, which was still pretty prodigious.

"Anyway," said Don, "thanks for letting me come back later to get the papers. I should be heading off."

"To the Art Gallery?"

"Actually, I thought I'd grab a bite first. Is there anywhere good around here?"

"There's the Duke of York," she said. "It's good. In fact . . ."

"Yes?"

"Well, I really am seriously thinking about applying to New Zealand. I'd love to pick your brain a bit. Mind if I join you for lunch?"

Chapter 21

Don and Lenore headed outside. The sun was high in the quicksilver sky, the humidity stifling. To the south, the CN Tower shimmered through the haze. The campus had been mostly empty, this being summer, but Bloor Street was packed with what was probably an equal mix of downtown businesspeople and tourists, plus a few robots, all madly hurrying somewhere. Don and Lenore chatted about New Zealand as they walked along.

"It's a great place," he said, "but I'll warn you, they've got this annoying tendency to put a slice of beet on hamburgers, and—oh, look!" There was a car parked at the curb. He pointed at its white and blue license plate: PQHO-294, with the hyphen, as was normal in Ontario, a stylized crown. "Qoph."

Lenore's eyebrows leapt up her forehead. "The name of a Hebrew letter!" she exclaimed with relish. "Do you play Scrabble?" Every serious Scrabble player had memorized the handful of acceptable words that had a *Q* but no *U* in them.

He smiled. "Oh, yes."

"Me, too," said Lenore. "I'm always practicing with license plates. A few weeks ago, I saw two cars side by side, and their plates were anagrams of 'barf' and 'crap.' I was smiling for days after that."

They continued on, talking some more about New Zealand, and by the time they arrived at the restaurant, they'd exhausted just about everything Don had to say on the topic. The Duke of York turned out to be a two-story-tall pub-style restaurant on a quiet street north of Bloor. The other buildings on the street, all classy renovated houses, seemed to contain the offices of high-priced lawyers and accountants. They were shown to a booth near the back on the pub's first floor, and settled in. Rock music—or whatever kids today called the stuff they listened to—was playing over the speakers. Mercifully, the place was air-conditioned.

There was a table near theirs, with three men seated at it. A server about Lenore's age, and almost as pretty, wearing a skin-tight black top scooped low to show a lot of cleavage, was taking that group's order for a bottle of wine to go with their meals.

"Red or white?" asked one of the men, looking at his friends.

"Red," replied the fellow on his left, and "red," repeated the guy on his right.

The first man tipped his head up to look at the server, and said, "I'm hearing red."

Lenore leaned over the table and whispered to Don, while indicating the guy who'd just spoken with a tilting of her head. "Wow," she said. "He must have synesthesia."

Don barked a delighted laugh.

The same server turned her attention to them. She was tall, and broad shouldered, with chocolate brown skin and

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waist-length blue-black hair. "Can I get you—oh, Lennie! I didn't realize it was you, honey!"

Lenore smiled sheepishly at Don. "I wait tables here two nights a week."

He suddenly had a nice mental picture of Lenore dressed like the server, whose name tag read "Gabby." Gabby put a hand on her rounded hip, appraising him. "So, who's this?" she said, with mock seriousness, as if Lenore's companion had to pass muster with her.

"This is my friend Don," said Lenore.

"Hello," he said. "Nice to meet you."

"You, too," Gabby said. She turned her attention back to Lenore. "See you at the bank on Saturday?"

"For sure."

Gabby took their drink orders. Lenore asked for a glass of white wine; Don ordered his old standby of Diet Coke. He was glad that the Coca-Cola Company and PepsiCo had finally merged; he used to hate that little game of "Is Pepsi okay?" in places that had served only that brand.

"So," he said, after Gabby left, "you're helping her rob a bank?"

Lenore looked a little embarrassed. "Food bank, actually. Gabby helps out there all the time. Me, I'm there most Saturdays." She paused, then, a bit awkwardly, as if she felt a need to offer some further justification: "Working in a restaurant, you see so much food go to waste, and yet people still go hungry."

He looked away, wondering how many—good Christ, how many *millions* of people could have been fed with the money that had been spent rejuvenating him.

Lenore was, as his answering machine had opined, a chatty sort, and he was mostly content to just listen to her ramble on; indeed, it was safer than him doing much talking. She had such an animated face, such a lively voice, that he could have listened to her for hours. Still, he made occasional efforts to keep up his end of the conversation. "So, you like Onderdonk," he said, indicating her T-shirt.

"Oh, they're warp," she replied. He had no idea whether that was good or bad, and kept a poker face. "What about you?" continued Lenore. "What groups do you like?"

Oh, shit, thought Don. He'd set himself up for this. The bands of his youth—ELO, Wings, Supertramp, April Wine—would mean nothing to her, and, for the life of him, he couldn't think of the name of any contemporary group. "I, um, ah . . ." And then, in a flash of brilliance, he pointed at the wall speaker, indicating the group that was playing now—not that he could name it, or the song.

But she nodded, impressed. "Hyperflower," she said. "Skytop." Don tried not to frown. One of those words was probably the name of the group; the other, a favorable reaction to his choice. If it had been her pointing at the speaker and oh, say, "Call Me"—a standard from his own university years—had been playing, he'd have identified the musician first, then added his assessment: "Blondie. Cool." So he assumed "Hyperflower" was the name of the band, and "skytop," a term of praise. *Just like decoding an alien language,* he thought. Sarah would be proud.

"Anybody else?" asked Lenore.

"Umm . . ." After a moment, in desperation, he said, "The Beatles."

"No way!" she squealed. "I love them! What's your favorite song of theirs?"

"'Yesterday.'"

She murmured appreciatively.

"It's unusual," he said, "liking the Beatles these days." Although once he said it, he was afraid he might be wrong. For all he knew, the Fab Four could be enjoying a general resurgence of interest right now. When he'd been in university, there'd been a huge Bogart revival on campuses, and Bogey's great films had been almost a half-century in the past, even then.

But she nodded enthusiastically. "For sure. Hardly anybody I know has even

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heard of them."

"How'd you get into them?"

She looked at him quizzically, and he thought that maybe he'd used a dated turn of phrase. But she must have sussed out its meaning because she said, "My grandfather had a collection of them."

Ouch.

She went on. "He used to play them for me whenever I came over as a kid. He had an antique stereo—that was his hobby—and a whole bunch of them on nylon."

It took him a moment to get it; she meant vinyl. But it wasn't polite to correct people when they made innocent mistakes—*his* grandfather had taught him that.

Still, thought Don, there had to be *something* they could discuss that wouldn't put him at such a disadvantage. Of course, they could have talked about the one person they both knew: Sarah. Isn't that what most strangers do? But he couldn't stand to hear another reference to his "grandmother."

Gabby returned with their drinks and took their food order. Don asked for something called "the blue steak salad"—sliced steak on garden greens with crumbled blue cheese. Lenore, who hadn't had to even glance at the menu—working here, she presumably knew it by heart—ordered fish and chips.

Don loved debating politics, but usually avoided it with people he'd just met. But there was a provincial election looming here, and, since Lenore was from British Columbia, she likely didn't have strong feelings about what was happening in Ontario; it was probably a safe topic. "So, who'd you like to see win on Friday?" Don asked.

"I always vote NDP," she said.

That made him smile. He remembered his own socialist days as a student. Still, as they continued to talk, he was impressed with how much Lenore knew about the current scene. But when history came up—

"Favorite prime minister? I guess I'd have to say Mulroney."

Don really got pissed off by the revisionist history that was popular these days. "Listen," he said, "I remember when Brian Mulroney was prime minister, and he—" He cut himself off when he saw her wide-eyed expression. "I mean," he quickly corrected, "I remember reading about when Brian Mulroney was prime minister, and he was even worse than Chrétien when it came to being sleazy . . ."

Still, why was he leaving his true age a secret? It wasn't as if he could keep it under wraps forever. People would eventually find out—including people at the astronomy department; Sarah was still in touch with several of them, and they had no pact to keep what had happened quiet. Besides, Lenore would probably be fascinated to hear all about his meeting with Cody McGavin, who, after all, was the patron saint of SETI these days. But whenever he contemplated the selective success of the treatment, the guilt cut him from within, like swallowed glass, and—

"Okay," said Lenore, "let's see what you're made of."

He stared at her, completely baffled, as she rummaged in her purse. After a moment, she pulled out her datacom and placed it on the table between them. She pressed a couple of keys, and it projected a holographic Scrabble board onto the wooden tabletop.

"Wow!" Don said. Although he had a nice collection of portable Scrabble boards—fold-up sets, magnetic sets, a set with self-stick vinyl tiles, dedicated electronic devices, even a miniature version that fit on a key chain—he'd never seen one this . . . this *skytop.*

"All right, Mr. Qoph," Lenore said. "Let's play."

Chapter 22

A spring evening in 2009. "Sweetheart, I'm home!" Sarah called out.

Don came out of the kitchen, crossed through the living room, and stood at

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the head of the six stairs leading down to the entryway. "How'd it go?"

It was The First International Collaborative Session for Dealing with the Message from Sigma Draconis, a three-day marathon, hosted by the University of Toronto, chaired by Sarah herself, with SETI experts from all over the world having flown in to attend.

"Exhausting," said Sarah, sliding aside the mirrored closet door and hanging up her raincoat; April was Toronto's wettest month. "Contentious. But ultimately worthwhile."

"I'm glad," he said. "I've got a pot roast in the oven, by the way. It should be ready in about twenty minutes."

The door to the house opened again and Carl came in, looking soaked and bedraggled. "Hey, Mom," he said. "How was the conference?"

"Good. I was just telling your father."

"Dinner in twenty minutes, Carl," Don said.

"Great. I'll wash up." Carl managed to get his wet shoes off without bending over or undoing the laces. He didn't take off his wet jacket, but just scooted up the stairs, slipping by Don as he did so.

"So, what happened?" Don asked.

Sarah came up to the living room, and they shared a kiss. "We started with an inventory of the unauthorized messages that we know have already been sent to Sigma Draconis."

"Like what?"

"There's a group that says it managed to render the opening of Genesis in the language the Dracons provided."

"Christ," said Don.

"No," she said. "He doesn't show up until the sequel. Anyway, another group has sent up a library of digitized Islamic art. Somebody else says he's sent a list of the serial numbers of all of the US soldiers killed in Iraq. Another person sent a version of the Mensa admissions test. He said instead of us worrying about passing the aliens' test, they should be worrying about passing one of ours; maybe they're not good enough to join *our* club."

"Huh," said Don.

"And there's been lots of music sent." Sarah moved over to the couch and lay down. He motioned for her to lift her legs so he could sit down at the far end. She did so, then she lowered her feet into his lap, and he began rubbing them for her.

"Mmmmm," she said. "That's nice. Anyway, Fraser Gunn was there—remember him? He argued that sending music was a mistake."

"Why?" asked Don. "Afraid of being sued by the copyright holders?"

"No, no. But, as he said, the only thing we've got to trade with aliens is our culture; that's the only thing you might want from another civilization. And if we give away the best stuff—Bach, Beethoven, the Beatles—we'll have nothing good to offer when the aliens say, hey, what have you got to swap for *our* best work?"

Don knew all about scraping the bottom of the cultural barrel. He was a DVD addict—more so as a collector than as an actual watcher. He'd been thrilled when all the great television of his childhood and teenage years had been released on DVD, and he'd snapped up the boxed sets: *Thunderbirds, All in the Family, M*A*S*H, Roots, Kolchak: The Night Stalker* and, of course, the original *Star Trek.* But the last time he'd been in Future Shop, all he'd seen in the new-releases section was forgotten crap like *Sugar Time!,* a seventies sitcom starring Barbi Benton, and *The Ropers,* a spinoff from *Three's Company* whose only virtue was that it proved the original *wasn't* the worst TV show ever made. The studios had gone through their good stuff at a breakneck pace, and were now desperately trying to find anything at all worth releasing.

"Well," he said, "maybe Fraser's right. I mean, the only thing SETI is good for is sending information of one sort or another, no?"

"Oh, I'm sure he *is* right," said Sarah.

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"But there's nothing we can do about it. People are going to send whatever they want to. It's turned Carl Sagan's old saying on its ear. He used to ask, 'Who speaks for the Earth?' The question really is, 'Who *doesn't* speak for the Earth?'"

"That's our number one product these days, isn't it?" said Don. "Spam."

He saw her nod ruefully. SETI, as he'd often heard Sarah say, was a mid-twentieth-century idea, given birth to by Morrison and Cocconi's famous paper, and, as such, it carried a lot of quaint baggage. The notion that governments, hopefully cooperating internationally, would control the sending and receiving of signals was a fossil of an earlier age, before cheap, mass-produced satellite dishes became common, allowing everyone everywhere to watch ESPN and the *Playboy* channel.

No, these days anybody who wanted to cobble together the equipment from off-the-shelf parts could build their own radio-telescope array. Using home-computer astronomy software to drive them, consumer satellite dishes could easily track Sigma Draconis across the sky. Such dishes separated by wide distances could be linked via the Internet, and with the aid of error-correcting and noise-canceling software, groups of them effectively formed much bigger dishes. The phrase "SETI@home" had taken on an all-new meaning.

Of course, the American FCC, and comparable bodies in other jurisdictions, had the authority to limit private radio broadcasting. At the urging of the SETI community, the FCC was trying to prosecute many of the individuals and groups that were beaming unofficial replies to Sigma Draconis. But those cases were almost certainly all going to be lost because of First Amendment challenges. No matter how powerful they were, tight-beam transmissions aimed at one tiny point in the sky had no impact on the normal use of the airwaves, and attempts to ban such narrowcasts were therefore an unwarranted infringement of free speech.

Don knew that some religious organizations, including a few new cults that had sprung up, had already built their own vast dishes, dedicated to beaming signals to Sigma Draconis. Some did it twenty-four hours a day; Sigma Drac never set in the sky for anyone whose latitude was greater than twenty degrees north.

And for those who just wanted to send one or two messages—crackpot theories, execrable poetry, political tracts—there were private-sector firms that had built dishes and offered various transmission plans. One of the best-known was Dracon Express, whose slogan was, "When it absolutely, positively has to be there 18.8 years from now."

Nine-year-old Emily appeared, having come up from the basement. "Hi, sweetheart," Don said. "Just a few minutes to dinner. Set the table, will you?"

Emily looked petulant. "Do I *have* to?"

"Yes, dear, you do," he said.

She let out a theatrical sigh. "I have to do *everything!*"

"Yes, you do," Don said. "After dinner, you have to go out and plow the fields for a few hours. And when you're done with that, you'll need to sweep all the streets from here to Finch Avenue."

"Oh, Daddy!" But she was grinning now as she headed off into the kitchen. He turned back to his wife, who was visibly trying not to wince every time Emily banged the plates together.

"So," he said, "did your group figure out precisely *why* the aliens are interested in our morality?"

She shook her head. "Some paranoid types think we're being tested, and, if found wanting, will be subject to retribution. Someone from France went so far as to suggest we were undergoing an evaluation by the Sigma Draconian equivalent of PETA, wanting to determine, before they came to eat us, whether we had the higher moral and cognitive standing of true intelligences,

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or were just dumb cattle."

"I thought it was an article of faith in SETI circles that aliens only communicated; they never actually go places."

"Apparently they didn't get that memo in Paris," said Sarah. "Anyway, someone else suggested that we're just one data point in some wider survey, the kind that would be summarized in multicolor pie charts in the Dracon counterpart of *USA Today.*"

A timer sounded in the kitchen. Don patted her legs, indicating she should let him up. She did so, and he headed in. He rinsed his hands, then opened the stove, feeling a rush of hot air pouring out. "And what about orchestrating the replies?" he called out. "What did you guys decide about that?"

Sarah called back, "Hang on, I'm going to wash up."

He got the oven mitts and removed the pot, placing it on the stove top.

"Where are the napkins?" Emily asked.

"In that cupboard," he said, indicating it with a movement of his head. "Just like yesterday. And the day before."

"Stacie said she saw Mommy on TV," Emily said.

"That's pretty cool, isn't it?" he said, opening the pot and stirring the vegetables surrounding the meat.

"Yeah," said Emily.

Sarah appeared in the doorway. "Something smells good."

"Thanks," said Don, then, shouting, "Carl! Dinner!"

It took a few minutes to get everyone seated and served, then Don said, "So, what *are* you going to send the aliens?"

"We're going to do what they asked. We're going to set up a website, based at U of T, and let people from all over the world answer the questions the aliens asked. We'll pick at random a thousand completed surveys, and send them off."

Carl was reaching for the dinner rolls. "Hey," Don said, "come on, Carl. Don't reach halfway across the table. Ask your sister; she'll pass them."

Carl sighed. "Can I have the rolls?"

"Say please," Emily said.

"Dad!"

Don was tired. "Emily, give your brother the rolls."

Scowling, she did so.

"Why do you suppose they want a thousand sets of responses?" continued Don. "Why not just, you know, send a summary—like, *X* percent chose answer *A*, *Y* percent chose *B*, and so on."

"This isn't *Family Feud,*" said Sarah.

Don chuckled.

"Seriously," said Sarah, "I suspect it's because if you summarize it all, you'd never see the seemingly contradictory stuff. You know, saying that *X* percent are against abortion and *Y* percent are for the death penalty doesn't let you draw out the fact that, often, it's the same people who are pro-life and also pro-capital punishment. Or, for that matter, the aliens might consider my own beliefs to be bizarrely contradictory. Being both pro-choice and anti-capital punishment could be interpreted as meaning you're in favor of murdering innocent children but against killing those who could be said to deserve it. I'd never put it that way, of course, but combinations like that are interesting, and I guess they don't want them to get lost in the data."

"Sounds like a plan," Don said, while carving another piece of roast for Carl. "But what about your own answers?"

"Sorry?"

"You figured out that it was a survey," he said. "Surely one of the thousand sets of answers sent should be yours."

"Oh, I don't know about that . . ." Sarah said.

"Sure, Mom," said Carl. "You've got to include your own answers. It's your right."

"Well, we'll see," said Sarah. "Emily, would you please pass the peas?"

Chapter 23

After lunch, Lenore headed back to the university, and Don made his way

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down to the Art Gallery. He'd been impressed by the young lady's Scrabble play. She had a terrific vocabulary, a good strategic sense, and didn't take too long to make her moves. Although he did ultimately win, she had the best single turn, placing *oxlip* vertically starting at the triple-word-score square in the upper-left corner of the board.

The Art Gallery of Ontario had the world's largest collection of Henry Moore sculptures, as well as major collections of European Old Masters and Canada's Group of Seven, plus a permanent exhibition of Helena van Vliet water colors—and although Don had seen all of those before, he enjoyed looking at them again. But it was the traveling exhibition of blown glass by Robyn Herrington that had really brought him here today, and he took his time admiring each piece. He had a fondness for art forms that required genuine manual skill; so often, today's digital arts substituted patience for real talent, he thought.

The AGO was popular with tourists, and he had to put up with being jostled a fair bit—but at least it didn't actually hurt to be bumped by people anymore; until recently, he often used to ache for hours after colliding with a wall or another person.

His favorite Herrington piece, he decided, was a yellow fish with big blue eyes and giant pink lips; somehow, out of molten glass, the artist had imbued great personality into it.

After he'd seen his fill, Don headed outside and started making his way back to the university to pick up the pile of papers. Rush hour had begun and the traffic on the streets was already bumper-to-bumper. By the time he got back to the fourteenth floor of the McLennan tower, it was a quarter to five, but, as promised, Lenore was still there.

"Hi, Don," she said. "I was beginning to think you'd fallen into a black hole."

He smiled. "Sorry. Lost track of time."

"How was the exhibition?"

"Terrific, actually."

"I put your papers into a couple of bags for you, so they'd be easier to carry."

And who said young people today were inconsiderate? "Thanks."

"It's too bad it's so late," Lenore said. "The subway will be jam-packed, at least for the next ninety minutes. Sardine-city."

"I hadn't thought about that," he said. It had been years since he'd had to come home from downtown in rush hour. A tin can full of sweaty, exhausted people didn't sound very pleasant.

"Look," said Lenore, "I'm about to head back to the Duke of York."

"Again?" said Don, astonished.

"I get a discount there. And it's Tuesday night—that's wing night. Me and a few other grad students meet there every week. Why don't you come along? You can hang with us until the subway traffic dies down a bit."

"Oh, I don't want to intrude."

"It's no intrusion."

"I, um . . ."

"Think about it. I'm going to have a pee before I head out." She left the office, and Don looked out the little window. In the distance, beyond the campus, he could see gridlocked streets. He reached into the pocket of his shorts, and pulled out his datacom. "Call Sarah," he said to it, and a moment later he heard her saying, "Hello?"

"Hey, hon," he said. "How are you?"

"Fine. Where are you?"

"Actually, down at your old stomping grounds. Just picking up the papers you wanted."

"How was the exhibit at the AGO?"

"Good; I'm glad I saw it. But, listen, I really don't want to face the rush-hour crush on the subway."

"No, you shouldn't."

"And Lenore here, and a few other grad students, are going out for chicken wings, and—"

"And my husband loves his wings," Sarah said, and Don could hear the smile

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in her voice.

"So would you mind if . . . ?"

"No, not at all. In fact, Julie Fein just called. They've got theater tickets for tonight, but Howie's not feeling up to going, so she wanted to know if I wanted to go; I was just about to call you."

"Oh, for sure. Go. What are you going to see?"

"*Fiddler on the Roof,* at Leah Posluns." Just a few blocks from their home.

Don did a decent Topol impersonation, and he sang a few bars of "If I Were a Rich Man"—he liked any song that properly employed the subjunctive. Then he added, "Have a wonderful time."

"Thanks, dear—and enjoy your wings."

"Bye."

"Bye."

Just as Don was closing up his datacom, Lenore came back into the room. "So, what's the verdict?" she asked.

"Thanks," he said. "Wings sound great."

When Don and Lenore arrived back at the Duke of York, Lenore's friends had already shown up. They were seated in a small room to the left on the ground floor, an area Lenore said was called "the snug."

"Hey, everybody," Lenore said, pulling out a captain's chair and sitting down. "This is my friend Don."

Don took a seat, as well. Two small round tables had been shoved together.

Lenore indicated a lanky Asian man in his twenties. "Don, this is Makoto. And this is Halina" (petite, with brown hair) "and Phyllis" (a blond who looked like she'd be quite tall, if she were standing up).

"Hi, everybody," Don said. "Thanks for letting me join you." A moment later, Gabby, who was still on duty, came by. He listened as she recited what was on draft, and he ordered an Old Sully's Light, the only low-carb beer on the list.

Lenore immediately dove into the current topic of conversation, something about a guy they knew having gotten into a fight with his girlfriend. Don settled into his chair and tried to get a handle on the personalities. Halina didn't seem to ever speak, but she had an expressive face that reacted—indeed, overreacted—to whatever the others were saying: eyebrows shooting up, jaw dropping, big smile, bigger frown; she was a living series of emoticons. Phyllis had what seemed to Don to be a juvenile and bawdy sense of humor, and she made liberal use of the F-word. Makoto looked unhappy that Don was there; perhaps he'd been counting on being the only guy with three beautiful women.

Don mostly just listened to the conversation for the next little while, laughing a bit at those jokes he got, and drinking beer. He knew he could have joined in the discussion, but what they were talking about was so trivial, and they seemed to blow their little life crises out of any reasonable proportion: being away from home for the first time, petty social dynamics, and so on. Makoto, Halina, and Phyllis didn't have a ghost of an idea what it was like to have lived a life, to have raised kids and had a career. Lenore *did* have interesting things to say, and he paid attention when she was speaking, but when the others were talking he found himself mostly eavesdropping on the middle-aged couple at the next table, who were having a spirited discussion about how they thought the Conservative party was going to rout the Liberals in the upcoming election, and—

"Did you see Sarah Halifax on TV last week?" Makoto said to the others. "A fucking corpse walking. She must be like a hundred and ten."

"She's only eighty-seven," Don said evenly.

"'Only,'" said Makoto, as if repeating a punchline for the benefit of those who might not have heard it.

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Lenore spoke up. "Makoto, Don is—"

Don cut her off. "I'm just saying, Sarah Halifax is not that old."

"Yeah, well, she looks like Gollum," said Makoto. "And she must be completely senile."

Halina nodded vigorously but said nothing.

"Why do you say that?" Don said, trying to keep his voice even.

"Don't get me wrong," said Makoto. "I know she figured out what the first message meant. But the TV thing said Cody McGavin thinks the old bat is going to figure out the new message, too." He shook his head in a "can-you-imagine" sort of way.

"Speaking of messages," said Lenore, gamely trying to change the topic, "I got a call the other day from Ranjit at CFH. He says—"

But Don couldn't help himself. "Professor Halifax understands the Dracons better than anyone."

Makoto waved a hand dismissively. "Oh, she might have back in her day, but—"

"This is *still* her day," said Don. "She's Professor Emerita, remember—and without her, we wouldn't be communicating with the Dracons at all."

"Yeah, yeah," said Makoto. "But if McGavin would put some of his money behind someone who's got a chance—"

"You mean you," Don snapped.

"Why not? Better someone born this century, this millennium, than a dried-up old fossil."

Don looked down at his half-empty beer bottle, trying to remember if he was on his second or third. "You're being unfair," he said, without looking up.

"Look, Dan," Makoto said, "this isn't your field. You don't know what you're talking about."

"It's Don," Lenore said, "and maybe he should tell you who—"

"I *do* know what I'm talking about," said Don. "I've been to Arecibo. I've been to the Allen."

Makoto blinked. "You're full of shit. You're not an astronomer."

Damn. "Forget it." He got up, his chair making a loud wooden *whack* as it collided with the table behind them. Lenore looked at him in horror. She clearly thought he was going to take a swing at Makoto, and Makoto had a "just-try-it" scowl on his face. But he simply said, "I'm going to the john," and he squeezed his way past Halina and Phyllis, and headed for the stairs leading down to the basement.

It took a while to empty his bladder, which was probably just as well; it gave him some time to calm down. Christ's sake, why couldn't he have just kept his mouth shut? And he knew what conversation was going on back in the goddamn snug. "Shit, Lenore, that friend of yours is—" and Makoto would plug in whatever term kids today used for "touchy" or "crazy."

Kids today. The urinal flushed as he turned around and walked to the sink. He washed his hands, avoiding looking at his reflection, then he climbed back upstairs. When he sat down, Lenore glared expectantly at Makoto.

"Look, man," Makoto said, "I'm sorry. I didn't know she was your grandmother."

"Yeah," said Phyllis. "We're sorry."

He couldn't bring himself to respond in words, so he just nodded.

There was more conversation, although Don didn't say much, and lots of wings were eaten; the primal tearing of flesh from bone with his teeth actually helped calm him down. Finally, the bill came. After paying his share, Makoto said, "Gotta motor." He looked at Don. "Nice to meet you."

Don managed a calm tone. "And you."

"I should go, too," said Phyllis. "Got a meeting with my supervisor first thing in the morning. You coming, Halina?"

"Yeah," said Halina, the only word Don had heard from her all evening.

When they were alone, he looked at Lenore. "I'm sorry," he said.

But she lifted her rusty eyebrows. "For what? For defending your grand-

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mother who wasn't here to defend herself? You're a good man, Donald Halifax."

"I'm sure I spoiled your fun. I'm sorry your friends don't like me, and—"

"Oh, they do. Well, maybe except for Makoto. But while you were in the washroom, Phyllis said you were gallant."

He felt his jaw go slack. "Gallant" wasn't the sort of word one normally applied to a twenty-five-year-old.

"I guess I should be going, too," he said.

"Yeah," she said. "Me, too."

They headed out the pub's doors, Don carrying his two plastic bags full of file folders. To his surprise, it was now dark; he hadn't realized how long he'd been in the pub. "Well," he said, "that was fun, thanks, but—"

Lenore seemed surprised that it had grown dark, too. "Walk me home?" she asked. "It's only a few blocks, but my neighborhood's a bit rough."

Don looked at his watch again. "Um, sure. Okay."

She took one of the bags, and they made their way along, Lenore chatting in her animated way. It was still hot and sticky as they came to Euclid Avenue, a tree-lined downtown street filled with crumbling, ancient houses. Two beefy guys passed them. One, with a shaved head that glistened in the light of the street lamps, had an animated tattoo of the grim reaper on his bulging right biceps. The other had laser scars on his face and arms that could easily have been erased; he was presumably wearing them as badges of honor. Lenore cast her gaze down at the cracked and broken sidewalk, and Don followed her example.

"Well," she said, a hundred meters or so farther along, "here we are." They were standing in front of a dilapidated house with dormer windows.

"Nice place," he said.

She laughed. "It's scuzbum. But it's cheap." She paused, and her face grew concerned. "Look at you! You must be parched in this heat, and it's a long walk back to the subway. Come on in. I'll give you a Diet Coke to take with you."

They walked around to the side of the house, and some animal—a raccoon, maybe—quickly moved out of their way. Lenore opened the side door and led them down the stairs.

He braced himself for the place to be a mess—he remembered his own student days—but her apartment was tidy, although the furniture was a mismatched array, presumably of garage-sale acquisitions.

"Very pleasant," said Don. "It—"

Her mouth was on his. He felt her tongue pressing against his lips. His mouth opened, and his penis grew instantly hard. Suddenly her hand was on his zipper, and—*Oh, my!*—she was on her knees, taking him into her mouth . . . but only for a few spectacular seconds. She rose to her feet, took his hands, and, walking backward, facing him, a lascivious smile on her face, she started pulling him toward the bedroom.

He followed her in.

Don was terrified that he'd come too soon. This was, after all, more excitement and stimulation than he'd had in years. But the old boy kept himself in check as he and Lenore rolled around—now him on top, now her on top—until finally he did come. He immediately went back to work until, at last, she had a shuddering orgasm, too.

"Thank you," she said, smiling at him, as they now lay side by side, each facing the other.

He lightly traced the line of her cheek with his index finger. "For what?"

"For, um, making sure that I . . ."

His eyebrows went up. "Of course."

"Not every guy, you know, cares . . ."

She was totally naked, and the room's lights were on. He was delighted to see that the freckles were everywhere, and that her pubic hair was the same coppery shade as the hair on her head. She seemed totally at ease with her nudity.

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Now that they were done, he wanted to scoot under the sheet. But her body was pinning the sheet in such a way that he couldn't get under without making a big deal out of it. But as her finger played with the hair in the middle of his chest, he was uncomfortably conscious of her scrutiny.

"No scars," she said, absently.

The dermal regeneration had gotten rid of all Don's old ones. "Just lucky, I guess."

"Well," said Lenore, whapping him playfully on the arm, "you certainly got lucky tonight." And she made a big O with her mouth.

He smiled at her. It had been *amazing.* Tender yet spirited, gentle and vigorous all at once. It wasn't quite sleeping with a supermodel—but it would do! Oh, yes, it would do!

His hand found her nipple, and he tweaked it lightly between thumb and forefinger. "The pallid bust of Pallas," he said softly, smiling at her.

Her eyes went wide. "You're the first guy I've met who knows more of that poem than just the 'nevermore' part. You don't know how sick I got of people intoning 'nevermore, nevermore' at me."

He stroked her breast gently, and said:

"And the raven, never flitting
still is sitting, still is sitting
"On the pallid bust of Pallas
just above my chamber door

"And his eyes have all the seeming
of a demon's that is dreaming

"And the lamp-light o'er him streaming
throws his shadow on the floor

"And my soul from out that shadow
that lies floating on the floor

"Shall be lifted—nevermore!"

"Wow," said Lenore, softly. "I've never had a guy recite poetry to me."

"I've never had a girl challenge me to Scrabble before."

"And I want a rematch!" she said.

He raised his eyebrows. "Now?"

"No, not now, silly." She pulled herself closer to him. "In the morning."

"I—I can't," he said. He felt her stiffen against him. "I, um, I've got a dog."

She relaxed. "Oh. Oh, okay."

"Sorry," he said. He meant "for lying," but let her take it to mean "for not being able to stay." He scanned around the room for a clock, saw one, and his heart jumped. "Look," he said, "I, um, I really do have to get going."

"Oh, all right," said Lenore, sounding not at all happy about it. "But call me! I'll give you my number . . ." □

To be continued.

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Glasshouse, Charles Stross, Ace, $24.95, 335 pp. (ISBN: 0-441-01403-8).

Thunder of Time, James F. David, Tor, $27.95, 400 pp. (ISBN: 0-765-30770-7).

Schlock Mercenary: Under New Management, Howard Tayler, $15.00, 80 pp. (ISBN: 0-9779074-2-2).

The General, Rick Sutcliffe, Writers Exchange E-Publishing, $3.95, $2.96 from Fictionwise (http://www.fictionwise.com) (ISBN: 1-920972-65-X).

The Year's Best Science Fiction: Twenty-Third Annual Collection, Gardner Dozois, ed., St. Martin's, $19.95, 660 + xlii pp. (ISBN: 0-312-35334-0).

James Tiptree, Jr.: The Double Life of Alice B. Sheldon, Julie Phillips, St. Martin's, $27.95, 449 + xii pp. (ISBN: 0-312-20385-3).

Heinlein's Children: The Juveniles, Joseph T. Major, Advent, $25.00, 535 + xvi pp. (ISBN:0-911682-34-1).

Ten Worlds: Everything that Orbits the Sun, Ken Croswell, Boyds Mills Press, $19.95, 56 pp. (ISBN: 1-59078-423-5).

Julie Czerneda began a new and intriguing series—Species Imperative—with *Survival* (reviewed here in October 2004), in which salmon researcher Mackenzie (Mac) Connor was enlisted to investigate why many worlds were being attacked by something that left large areas stripped of all life. By the time she was done, the truth was out: The alien Dhryn metamorphosed into a "feeder" form and were surely responsible for the long-lifeless worlds of the Chasm as well as for the current threat. Invisible aliens called the Ro, feared by the Dhryn, may be an essential ally, except that they are not terribly forthcoming.

In the series' second volume, *Migration* (reviewed here in November 2005), Mac became a major player in a huge Interspecies Union research effort that in due time revealed the Dhryn to have some remarkable similarities to her beloved salmon and the Ro to be villainous on a scale to rank with any of the creations of the late E. E. "Doc" Smith. Volume three is **Regeneration**, and it does an excellent job of resolving mysteries and assuring a happy future for both the galaxy and Mac. Her old friend Emily Mamani, still more than a bit twitchy from her mangling by the Ro, is now set to work on a tracking device to find whatever the Ro have left in Earth's oceans. Mac herself, less twitchy because less mangled, has to deal with the "idiot" faction that continues to view the Ro as representing salvation from the evil Dhryn as she prepares to visit a Dhryn world. That's when a fleet of Dhryn derelicts is discovered and her team is redirected to checking out the ships. Once there, they discover a single Dhryn survivor, one of the "Wasted" who have failed their metamorphosis into the "Progenitor" (think queen bee) form. It is near starvation, but a human medic analyzes the evidence from the

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Dhryn homeworld and finds a diet that not only revives the survivor but has marvelous and informative effects. The villainy of the Ro is greater than anyone had suspected!

Czerneda has a touch with aliens that makes me think her world would be a great one to live in. Her humans too—from the officious Oversight (Charles Mudge) to the delectable Nik—are convincing. Her trilogy here reaches its natural and satisfying conclusion, but I wish there were more to come.

And perhaps there is. Emily Mamani is obsessed with the legend of the Survivors, aliens that somehow escaped the ancient devastation wrought in the Chasm. She plans to hunt them out, and that should provide at least one more book. I will look forward to it.

In Charles Stross's Accelerated future, people can be transmitted hither and yon by Gates that use nanotechnology to disassemble whatever goes in, read out the identity and location of every atom, transmit the data to a destination Gate, and assemble a duplicate. The data can of course be saved, so a person can be backed up or put into a kind of digital "suspended animation." The data for objects can also be saved, so a Gate is a great way to manufacture whatever one needs, whether clothes or weapons. And since it's all just data, a person can be copied. (How many of me do you want? Just hit the print button.)

The data can also be edited, so there is an end to disease and injury and old age, as well as any idea that there is only one sort of human body. But there is also a new kind of war, which Stross sees in the old adage about those who do not remember history being condemned to repeat it. If this is true, he suggests, then those who would impose old-style tyrannies would do well to eliminate all memory of history. So he supposes a bit of software, known as Curious Yellow, that infects Gates, installs itself in people's communications implants, spreads as people are copied through the Gates, and when activated destroys memories of the past. It also activates assassins aimed at historians.

To win such a war must mean destroying infected Gates, quarantining local tyrannies, and disinfecting people, as well as fighting old-style thud-and-blunder battles. Unfortunately, there can be no guarantee that every villain was found or that the villains will find no way to start the war again.

So much is background to **Glasshouse**, which begins when Robin, who used to be a historian, was a whole tank regiment during the war, and is now recovering from drastic memory editing, meets Kay, cute and four-armed. They get it on quite happily, and when she mentions a certain research study looking for memory-edited volunteers, he lets himself be tempted. The study involves setting up an old-style society (based on best guesses, given the loss of records in the war, of what things were like around 2000) to see how things like the war could happen.

Once in, Robin discovers he's not a guy any more. He's Reeve, and it's no big deal since he's switched before. But if Kay is there, she's been changed beyond easy recognition. And the study has no exit, surveillance is constant and total, you get points for acting in character (including getting pregnant), church displays rather strange symbology, and the folks in charge seem more than a little over the top.

If the set-up reminds of Zimbardo's prison role-play study (in which college students showed how easy it was to start being rather brutal), it is surely deliberate; Stross even mentions Zimbardo at one point. But there's more than role-play going on. Reeve's dreams bring awareness that she is on a mission of infiltration. Memory creeps back. The reader learns about the background to the story and grows just as alarmed as Reeve, and as discouraged, for in a world where the self can be easily edit-

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ed, what room is there for rebellion or dissent?

If you love freedom and liberty, you may well see the Accelerated future as the epitome of personal choice. But there is this other side to the coin, for the choices can be those of others, imposed upon you willy-nilly. The heaven of free choice can become the hell of no choice all too easily. It's easy to root for Robin/Reeve and to cheer when the good guys prevail. But at the same time it's hard to see how they had any real chance at all. If the villains had been just a little less sloppy . . .

Still, I recommend it to you as both thought provoking and entertaining. Stross keeps doing very well indeed.

Ten years ago, says the puff sheet, James F. David "burst onto the scene with the exciting time-travel novel, *Footprints of Thunder*. The basic notion was that suddenly patches of prehistoric jungle, complete with dinosaurs, popped into the modern world (with the corresponding modern patches presumably popping into the ancient world). The phenomenon was quickly dubbed "time-quilting," it was blamed on nuclear testing, and a bit of nuclear counter-blasting scrambled the responsible time waves and stopped the problem.

Now David is back with **Thunder of Time**, whose premise is that the problem was stopped only temporarily. Now it's back, and it's not just bits of the dinosaurian landscape that are popping up. Time is getting scrambled, and the end of human civilization is at hand! But never fear, Kenny Randall of the earlier book left behind enough theory to give the computer modelers a hand, and Nick Paulson is on the case, begging for funding to investigate mysterious pyramids on the moon and in the Yucatan. He's also curious about hints of a mysterious government project in Alaska, and when no one will talk, he sets his girlfriend, Elizabeth, on the trail.

That turns out to be another pyramid, and as we learn why the ecoterrorist wants to blow it up with a quartet of bootleg nukes, we learn why pyramids. It's all about orgone energy, you see. That's what makes the time-quilting happen, that's why the government suspects a nefarious hand behind the ongoing disaster, that's what the government project is about studying and learning to control, and that's what the ecoterrorist wants to harness to create a world without humans (except for himself and his harem). Schemes aplenty, and those are what Nick, Elizabeth, John Roberts, Ripman, and even Kenny Randall have to stop, if they can avoid hungry tyrannosaurs and blood-crazed Mayans. They also have to choose what sort of world to have when all is said and done.

I suppose it would make a great movie. It's got enough melodrama and violence to make two! But as soon as David mentions pyramid power and orgone energy—both as thoroughly debunked as phrenology and phlogiston!—suspension of disbelief flies out the window. There is no plausibility, not the sort we are accustomed to in SF, where the made-up bits at least try to be consistent with what we know to be true, nor even the sort we accept in fantasy, where the consistency is with myth and legend and sometimes fairy tales. Here the consistency is with outright falsehood, and it does not work.

Don't waste your money.

It is perhaps not astonishing how many web-comics there are, but it is astonishing how many are actually quite good. As a case in point, you should look at "Schlock Mercenary" (http://www.schlockmercenary.com), whose creator, Howard Tayler, has just released his first book, **Schlock Mercenary: Under New Management** (introduction by John Ringo). The galaxy is occupied by a great many sentient species, a number of which are found in Captain Taff Tagon's crew aboard the *Serial Peace-*

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maker. One of the most charming of the characters is Schlock, who resembles a giant pile of dog poo and hides blasters in his tummy. There's a mad scientist, Kevyn Andreyasn, who has nearly a billion matterporter and time clones wandering around; not surprisingly he keeps popping up. There are women, busty but deadly. In the book's bonus tale (never seen online), there are even evil clowns!

And that's enough to give you the flavor: Inventive and humorous. Look at it online, and then buy the book, if Tayler has any left.

Rick Sutcliffe's **The General** is the fourth volume in his Worlds of the Timestream: The Interregnum series. I reviewed the first volume, *The Peace*, back in May 2001.

Sutcliffe is a professor of computing science and mathematics at Trinity Western University in British Columbia. His fiction he very aptly calls "Christian Science Fiction with an Irish flavour." The setting is the "Worlds of the Timestream," a handful of parallel Earths separated by important crisis points. One such point was the Crucifixion; in our own Earth, it happened as we believe; in the world of the story, Pilate released Jesus and Christianity developed with a very different flavor, especially once Ireland came to dominate the world under the High Lord of Heaven. Technology developed centuries ahead of our own schedule, and Irish customs of honor came to govern war and politics. The series began when the King was deposed and his clan was banned for sixty years, a period the series tracks as the King's kin and friends build a web of sworn loyalties that will someday permit their grandchildren to reclaim the throne.

In *The General*, those grandchildren are front and center, and the day of their ascendance is not far off. But the nobility are corrupt. There are plots and schemes and conspiracies in plenty, and it's a darned good thing that the grandchildren are supremely skilled at swordplay, computers, history, and everything else that might be needed. When Mara Meathe comes to court in 1997 and claims her place, ruler Donal XII promptly assigns her to a series of challenging tasks, which she accomplishes with remarkable displays of good sense. Meanwhile—beginning in 1987—Tadgh O'Kelly is working his way up the ranks with a series of forensic investigations that hint at the sort of very nasty kinds of human experimentation and sacrifice that make it no surprise when later the villains reveal an agenda that reminds us of the Nazis of our own world. Jump to 1998, when Sutcliffe introduces us to an amnesic patient in a nursing home on our Earth. Memory struggles to return: an airplane crash, capture, swords hacking at her body. An internal voice, an implanted computer system, hints at her past. There is no name. But as the story develops from 1997, the reader begins to guess. In due time, the heroes—good Christians all, and the best of them Born-Agains—prevail; the amputee is rescued and restored to her position, and the villains are thrown down. Some of them anyway. The series is by no means finished.

The Irish flavor is well handled. The Christianity, however, is not just cultural world-building. There is a good deal of God-talk, good boys and girls remain virginal till married, and liberalism is a corruption of the body politic. Check Sutcliffe's homepage biography (http://www.arjay.bc.ca/biog.htm) and you can see pretty quickly that this is his life. Yet you don't have to share his beliefs to enjoy the story. It works well as multigenerational dynastic intrigue. The biggest flaw—one hardly unique to this series—is the way the author lapses from time to time into textbookish summary mode, telling the reader what happened rather than showing.

And you can hardly beat the price!

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I'm looking at this one in May, so it can't possibly be what it says it is, the best SF of 2006. In fact, every one of the thirty stories in **The Year's Best Science Fiction: Twenty-Third Annual Collection** appeared in 2005. But Gardner Dozois has still done an excellent job of finding excellent SF by the likes of Michael Swanwick, Robert Reed, Bruce Sterling, Vonda N. McIntyre, Gene Wolfe, and many more. Many of the names are familiar from our bookshelves. A few—Paolo Bacigalupi, Hannu Rajanieme, Dominic Green, David Moles—are new, at least to me. Source publications are varied, perhaps more than the last time I looked at one of these volumes; perhaps it has served the reader well for Dozois to give up magazine editing. *Analog* is represented twice, with Harry Turtledove's "Audubon in Atlantis" and Mary Rosenblum's "Search Engine."

As usual, an excellent survey of recent SF, complete with a long essay summing up developments in publishing, TV, and film, and a long list of Honorable Mentions which could easily keep you reading until the next volume comes out.

James Tiptree, Jr., was famous for two things. First, he wrote excellent, insightful stories that took the SF field in new directions, stories that were "brilliant and disturbing . . . urgent messages from some haunted house on the corner of Eros and Mortality." Second, he didn't exist. After the debut, after the praise for being a man who (at last!) understood women, "he" turned out to be a woman, Alice Sheldon, whose early photos show her on safari with her parents, who eloped soon after her coming out, who worked for years for the CIA, who became a psychologist, and who eventually committed suicide. A troubled genius, of exactly the sort whose story begs to be told in detail, which is exactly what Julie Phillips does in **James Tiptree, Jr.: The Double Life of Alice B. Sheldon**.

The book is fairly standard in form—parents, childhood, youth, discovering SF&F, developing a rebellious streak, and running head-on into the inevitable conflicts that awaited any woman who wanted to be independent in the 1930s. Phillips uses letters of Alice Sheldon and her mother, interviews with family members and colleagues, and a great deal of research to assemble the story of who Sheldon was, what made her that way, why she wrote, and finally why she died. The result is one more book that deserves a place in every SF reader's library.

A major foundation block for Robert A. Heinlein's reputation is the dozen novels known as the "Heinlein juveniles." They began with *Rocket Ship Galileo* in 1947 and continued through *Have Space Suit, Will Travel* (1958), all from Scribner's, and they introduced a generation of kids to the solar system and the galaxy and the wonderful adventures waiting to be embarked upon. Some of those kids became the rocket scientists who put astronauts on the moon in the '60s. Some became science fiction writers, many of whom are still mining the claims staked out by Heinlein and struggling to meet the standards Heinlein set.

After 1958, Heinlein signed with Putnam for the still youth-oriented but more adult-toned *Starship Troopers* and *Podkayne of Mars*. All fourteen novels are discussed at length in Joseph T. Major's **Heinlein's Children: The Juveniles**. His focus is plot and context and interconnections, not literary and social significance, which makes the book an excellent survey for those who remember the juveniles fondly, wish a reminder but don't want to reread them all (there are so many new novels coming out, after all!), or who want to know what all the fuss was and is about. In his introduction, Alexei Panshin (author of *Heinlein in Dimension*, 1968) does an excellent job of portraying Heinlein's impact on the kids of the time: His work was eye opening "growth food," a taste of

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the future (in *Space Cadet*, 1948, there is actually a pocket-sized phone of a very familiar sort *today*), and life-lessons galore.

This one is essential to any good SF collection.

It's for kids nine and up, but Ken Croswell's **Ten Worlds: Everything that Orbits the Sun** is still a coffee-table book, over-sized and loaded with gorgeous photos and paintings of planets and moons. What makes it kid stuff is surely its accessibility, a matter of length, simplicity of language, and price. It's the first book to include the newly discovered tenth planet beyond Pluto and its gentle introduction to the rest of the Solar System is entirely suitable for older readers who want to know a bit more.

I don't expect *Analog* readers are very likely to want this one for themselves. But *Analog* readers have kids and grandkids and friends, and though this is the December column, you're reading it in plenty of time to buy this one as a gift. ■

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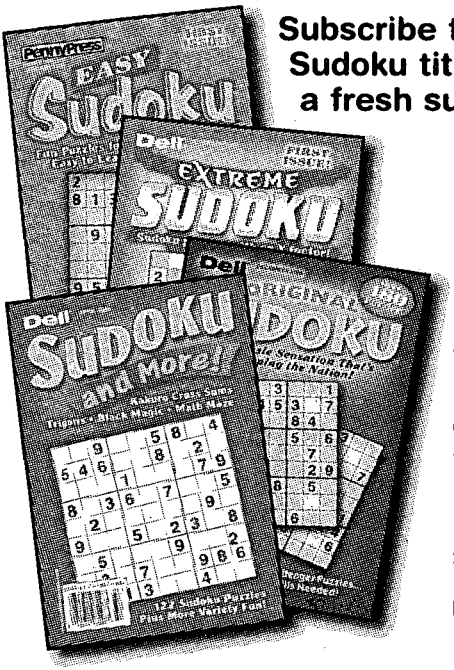

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BRASS TACKS

Dear Stan,

Michael Click's letter (June 2006 issue) sure raises a lot of possibilities for alternate universe storage. Apparently, however, he's not aware of Heinlein's usage of essentially the same concept in "Glory Road"; of course Heinlein was there first, though!

Also, he and Bob agree on at least one thing: military applications would be one of the premier uses.

I do have to disagree with one of his points: the one where he states that prisons and apartments would be essentially the same thing. I believe that this would be prevented by intent. Prisons, after all, are supposed to be places of *punishment*, not rest homes with luxury hotel rooms ("Camp Fed"-type prisons notwithstanding)! So while that *could* be done, I doubt very much that it *would* be done.

Howard Mark

Dear *Analog*,

I enjoyed "Puncher's Chance" in the June issue, and I liked the follow-on article about "MagBeam Plasma Propulsion" at least as much. In fact, it was the Science Fact article that prompted me to write this.

I'd like to address a couple of thoughts brought to mind by the article itself. For one thing, I note the absence of any mention of the effects of the projected ion beam on the orbiting platform. Ions have mass, and Newton's third law suggests that such a beam must produce some thrust that would act on the orbit of the platform itself. This effect might be trivial, in view of the relatively large mass of the platform, but it would seem to be something that would have to be handled in any real-world implementation of the scheme. Of course that would be an engineering problem, not necessarily needing to be discussed in an introductory presentation.

What intrigues me more, however, is the idea of a hybrid "first step" scheme for building the distal terminus of a magbeam route. This would entail using a platform in Earth orbit to boost a payload to Mars, for example; the payload might consist of a conventional (chemical rocket) system designed to place a small magbeam platform, or perhaps only part of one, in Mars orbit. Such a "one-ended" magbeam implementation would not be nearly as efficient as the finished product, but it could be used to bootstrap the process.

By the way, I assumed that this idea had sprung full-blown from my own mind, until I recalled (and re-read) a phrase from the story that says, "The magbeam harness is just strapped on." This leads me to suspect that my "original idea" is perhaps something that's already being evaluated. If so, so much the better!

Norm Mosher
Corinth, NY

Dear *Analog*,

I grew up on Staten Island New York City, which has electric commuter trains with a third rail on most of the tracks on the island. Also, I am familiar with the Pennsylvania Railroad that ran commuter trains across New Jersey, from

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Washington DC to New York City using overhead power lines for power. I also was exposed to the electric powered inter-urban trolley cars that traveled across Michigan from Lansing to Jackson and Battle Creek, back around 1923 to 1927. So the concept of using ground-based power to drive a mobile power system was not new to me.

However, I worked on the test planning for the development and early flight tests of ion propulsion in early space programs back in the 1960s. After all, we had to put the test item up into space where the vacuum available permitted ionization and acceleration of ionized gasses to generate a measurable thrust and payload attitude adjustment.

To me, the use of plasma propulsion was just something possibly useful for vehicle attitude control, too feeble to be ever useful for propulsion to Mars. Until I read James Grayson & Kathy Ferguson's very interesting story and article about a solar system commuter train.

Suddenly I realized that Professor R. M. Winglee had provided an answer to the main problem facing the proposals for establishing a Mars base for manned settlement as was proposed several years ago.

Clear back in 1963, I worked on a test-planning proposal for a manned flight to Mars using atomic power for thrust using superheated hydrogen for jet propulsion. Even with that plan, the flight to Mars took more than six months, making the proposal unrealistic even if the use of atomic power had been solved.

I retired from work as an engineer on space programs in 1990, but follow engineering progress yet via *Analog*.

I once had to justify an income tax deduction for the cost of taking a course in fiction writing that I made. The income tax inspector wanted to know why I deducted the cost of taking a course in fiction writing when I was an engineer. My answer was that "I write test plans that when written, look like science fiction, but often become true."

Regardless, I had to remove that deduction.

Henry M. Salisbury
Vista, CA

Brass Tacks;

As a former toiler in the uplink/downlink sync-sat trenches, I wonder what effect an inadvertent pass of the beam across dozens of satellites would have.

As a former toiler in the beam business, I wonder about beam-spreading attenuation at large distances.

As a former editor, I am puzzled by 4-page Brass Tack letters.

Jolyon Ramer
Winter Park, FL

Usually we limit "Brass Tacks" letters to about 1000 words, or a bit less than 2 printed pages, and prefer them as much shorter as their content will allow. However, we are not completely inflexible about length and will make rare exceptions if a letter covers enough ground. ■

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UPCOMING EVENTS Anthony Lewis

2–5 November 2006
WORLD FANTASY CONVENTION at Renaissance Hotel, Arboretum, Austin, TX. Guests of Honor: Glen Cook & Dave Duncan; TM: Bradley Denton; Editor Guest of Honor: Glenn Lord; Artist Guest of Honor: John Jude Palencar; Robert E. Howard Artist Guest: Gary Gianni. Registration: $125 until 31 July 2006; supporting $35. Info: http://www.fact.org/wfc2006/; wfcinfo@fact.org; FACT, Inc., Box 27277, Austin, TX 78755.

24–26 November 2006
LOSCON 33 (Los Angeles area SF conference) at Los Angeles Airport Marriott, Los Angeles, CA. Theme: Exploring the Golden Ages of Science Fiction. Guest of Honor: William Tenn; Fan Guest of Honor: Fred Patten. Registration: $35. Info: www.loscon.org; info@loscon.org; Loscon 33, c/o Los Angeles Science Fantasy Society, 11513 Burbank Blvd., North Hollywood, CA 91601

1–3 December 2006
SMOFCON 24 (Convention runners conference) at Hotel Phillips, Kansas City, MO. Registration: $60 until 31 October 2006, $70 at the door; supporting membership $25. Info: http://www.midamericon.org/smofcon/index.htm; SMOFCon 24, PO Box 414175, Kansas City, MO 64141-4175.

30 August–3 September 2007
NIPPON 2007 (65th World Science Fiction Convention) at Pacifico Yokohama, Yokohama, Japan. Guests of Honor: Sakyo Komatsu and David Brin. Artist Guests of Honor: Yoshitaka Amano and Michael Whelan; Fan Guest of Honor: Takumi Shibano. Registration: USD180/JPY20,000 until 30 June 2006, for thereafter. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Nominate and vote for the Hugos. This is only the third time Worldcon will be held in a non-English speaking country and the first time in Asia. Info: www.nippon2007.org; info@nippon2007.org; Nippon 2007/JASFIC, 4-20-5-604, Mure, Mitaka, Tokyo 181-0002. North American agent: Peggy Rae Sapienza, Nippon 2007, PO Box 314, Annapolis Junction, MD 20701, USA. UK agent: Andrew A. Adams, 23 Ivydene Road, Reading RG30 1HT, England, U.K. European agent: Vincent Doherty, Koninginnegracht 75a, 2514A Den Haag, Netherlands. Australian agent: Craig Macbride, Box 274, World Trade Centre, Victoria, 8005 Australia.

Attending a convention? When calling conventions for information, do not call collect and do not call too late in the evening. It is best to include a S.A.S.E. when requesting information; include an International Reply Coupon if the convention is in a different country. ■

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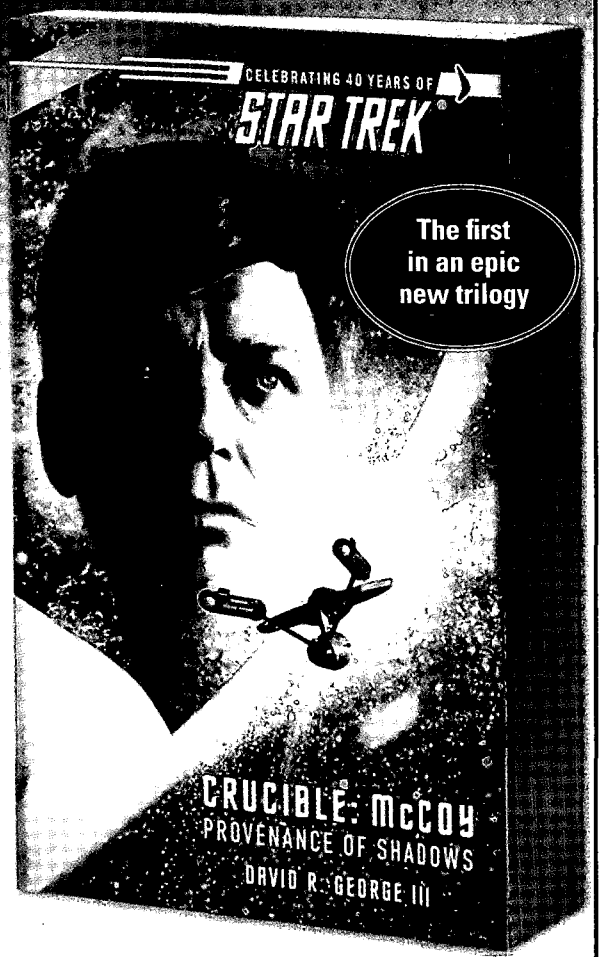

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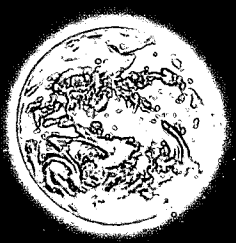

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